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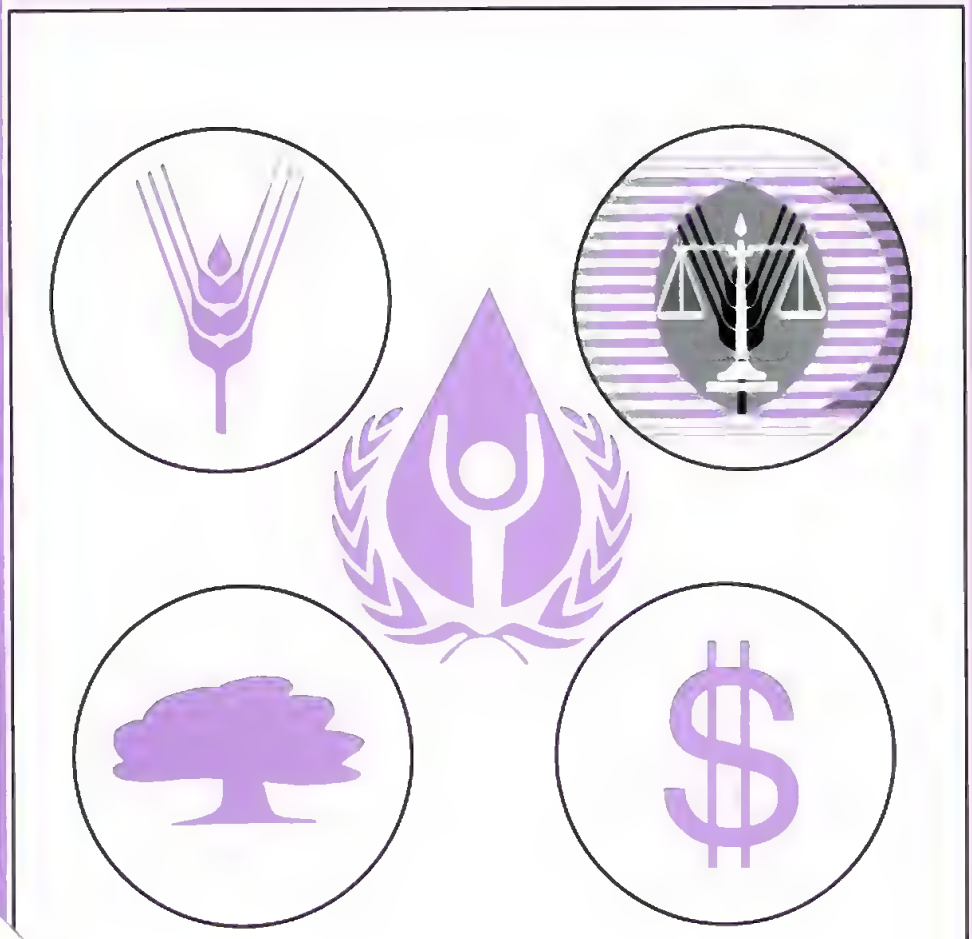
3

Water sector policy review and strategy formulation

A general framework



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Rome, 1995

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Foreword

Many countries have reached a state where the quantity or quality of fresh water resources is imposing limits on present use of the resource and on economic development. Others are rapidly approaching a similar critical situation. All these countries face the common problem that existing policies and strategies, and the institutions to implement them, are inadequate to meet water use needs and sustainable development.

In response to the problem, and to meet the challenge of the future, UN organizations, the World Bank and national governments have joined forces to promote reviews of water policies. The World Bank policy paper *Water Resources Management*, published in 1993, provides a conceptual framework and stresses the importance of a holistic approach to water resources management. Specific guidelines for processes and methods for water policy reforms and the formulation of water resources strategies were suggested in the subsequent joint UNDP-World Bank technical paper *A Guide to the Formulation of Water Resources Strategy*, published in 1994, and in *Reforming Water Resources Policy: A Guide to Methods, Processes and Practices*, published by FAO in 1995.

In September 1994, The Sub-committee on Water Resources of the UN Administrative Committee for Coordination (ACC-SWR) requested UNDP, FAO and the World Bank to prepare a joint guide on water resources policy review and reform and on strategy formulation. These agencies merged their respective publications, and FAO organized an expert consultation in January 1995 to review the joint document. The expert consultation included representatives of several UN agencies, the World Bank and several selected countries.

The framework presented here incorporates the recommendations of the expert consultation and makes the case for a systematic water policy review in two stages:

- Review and adaption of water policy, and
- Formulation of strategies.

Recognizing that policies and their implementation are the prerogatives of national governments, the focus of this guide is the approach and the process for formulating strategies and implementing water sector policies.

It is the hope that this guide will assist countries in their effort to review national water policies and re-assess national institutional capacity to implement the required strategic reforms, with the objective of sustainable resource management and rational water use.

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The World Bank/UNDP document was prepared by Ashok Subramanian, Mei Xie and Sandra Giltner, under the leadership of Guy Le Moigne (Senior Adviser, Water Resources, World Bank) and Frank Hartvelt (Deputy Director, Division of Science, Technology and the Private Sector, UNDP).

The synthesis of the two documents, undertaken by Hugh Turral, of the Overseas Development Institute, London, benefited substantially from the comments made by the experts participating in the Expert Consultation on Methodology for Water Policy Review and Reform, held in FAO, Rome, in January 1995.

Final editing for style and consistency and preparation for printing was by Thorgeir Lawrence, under the technical guidance of B.G. Appelgren.

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Executive summary

The Expert Consultation on Water Policy Review and Reform (Rome, 25-27 January 1995), concluded[1], with some exceptions, that methodology for water policy development do not generally exist at the country level, but that there is a need for individual countries to formulate, debate and adopt appropriate, national, provincial and basin-wide policies for rational water resources management.

The general framework presented in this document is based on elaboration of the strategic planning process outlined below, focusing on policy review and strategy formulation for water resources management. Policy review is intended to re-assess objectives, existing policy and status of the water sector, and to provide new goals and policies on which a detailed strategy can be based. The process of strategy formulation is concerned with the detail of how to put policy into practice at successively national, regional (basin) and local levels. It is, in one sense, between policies and programmes or projects, although it may indicate projects without formulating their details.

Water policy review and strategy formulation have many overlapping elements and are closely related, and the intent is to offer the different elements that together make up a review or strategy formulation process. It is for the countries to choose those elements that are applicable and most likely to develop a unique process that matches their unique needs. Hence the framework concentrates on elements.

Strategic planning is a continuous process and involves feedback and cross-over between monitoring and assessment (according to established criteria) of the results of implementation of strategy and the resulting programmes and projects. Reality is far more complex and is complicated by simultaneous strategic and shorter-term horizons and the strong likelihood of changing circumstances, plus changing interactions with other aspects of public policy and economic development. Thus the process of policy review and strategy formulation is also modified by political processes and human behaviour and has strong long-term evolutionary characteristics, as demonstrated in the ongoing reforms in water resources management in such countries as the United States of America, Spain and Australia.

The importance of capacity building is stressed when addressing the differences between the ideal and reality, and in particular the somewhat artificial phasing of activities of any framework. Capacity building involves:

- Creating an enabling environment with appropriate policy and legal frameworks.
- Institutional development, including community participation.
- Human resources development and strengthening of managerial systems.

The background, problems and principles of water resources management are discussed and provide a breakdown of sectorial activities, the social and economic characteristics of water and explain the reasons for extensive public intervention in the development, allocation,

1. FAO. 1995. *Methodology for Water Policy Review and Reform.* Proceedings of the Expert Consultation on Water Policy Review and Reform. FAO, Rome, 25-27 January 1995. FAO, Rome. 156p.

regulation and management of water resources. International meetings (ICWE, Dublin, and UNCED, Rio di Janiero, both in 1992) on water and the environment have focused popular attention on the increasingly limited availability of water resources and the need for improved management and conservation as a corollary to development. Rising population and the rapid rate of urbanization continue to increase demand for the basic services of potable water and sanitation and the need for secure food supplies. Irrigation is the dominant water user in many developing countries and faces increasing competition from other sectors, raising severe localized problems of re-allocation in some cases.

Counter-balancing these basic needs is the increasingly more expensive cost of developing new water supply infrastructure; consideration of the environmental needs for water and mitigation of the impact of water development; and the recovery of part or all of the operational costs of supply. Public expenditure by governments is increasingly burdensome and the worldwide pressure to minimize recurrent expenditure, recover costs and balance budgets is strongly evident in the water sector. The need for massive levels of new investment has also prompted renewed interest in attracting private sector finance to augment or relieve state commitments.

Component parts of the policy review include determining the importance of water in specific national and regional contexts, conducting a comprehensive water resources assessment and thereby generating a matrix of problems and critical issues, set against old and emerging objectives for water policy. Broad options, based on defined principles, are evaluated and set the scene for detailed strategy formulation, which establishes critical elements such as oversight bodies and expert teams and identifies all the interested parties (stakeholders). Extensive use of public consultation and participation is envisaged, although realistic assessments of the time, effort, cost and logistical feasibility of appropriate stakeholder participation is called for. The end point of the strategy formulation exercise is the definition of an action programme and implementation schedule.

The principle elements and key issues in strategy formulation are introduced with consideration of the need for a holistic and integrated approach to assessment, development and management of freshwater resources. Categories of actions determined in the policy analysis matrix are elaborated with consideration of data requirements and information management and the role of modelling in assessing options. Institutional and legal reforms are a major part of strategy formulation, encompassing specification, allocation and recognition of water rights, changes in organizational and ownership arrangements, and de-centralization and devolution of responsibility in public sector management. The role of economic tools and incentives and technological innovation are also introduced before more detailed consideration of the following key issues:

- institutions and human resources;
- stakeholder participation;
- information systems and management;
- the role of economics;
- environmental and health considerations; and
- international issues.

The final section draws together recent experience in water resources reform in Yemen, France, Mexico, England and Wales (United Kingdom), Victoria (Australia), Chile, Indonesia and Turkey, and attempts to emphasise the process of policy review and strategy formulation in practice. It highlights the outcomes of policy reform under the headings of water rights; privatization and corporatization; the promotion of price and market mechanisms; and reforms in planning and management.

Glossary of technical terms and abbreviations used

Aquifer	A water-bearing stratum of permeable rock or soil able to hold or transmit much water.
Assessment (water resources)	An examination of the aspects of the supply and demand for water and of the factors affecting the management of water resources.
Capacity building	The process of building organizations, human resources and the legal and regulatory framework needed for effective and efficient water resources management.
Catchment area	The area from which rainfall flows into a river, reservoir, etc.
CBA	cost-benefit analysis
CEA	cost-effectiveness analysis
Comprehensive water resources management	Water resources planning, development and control that incorporates physical, social, economic and environmental inter-dependencies.
Cost recovery	Fee structures that cover the cost of providing the service or investment.
De-centralization	The distribution of responsibilities for decision making and operations to lower levels of government, community organizations, the private sector, and non-governmental organizations (NGOs).
Delft Declaration	Declaration on Capacity Building, agreed at the UNDP Symposium *A Strategy for Water Resources Capacity Building*, held in Delft, the Netherlands, June 1991.
Demand management	The use of price, quantitative restrictions and other devices to limit the demand for water.
Dublin Statement	The Dublin Statement on Water and Sustainable Development, adopted at the International Conference on Water and the Environment (ICWE).
Ecosystem	A complex system formed by the interaction of a community of organisms with its environment.
EIA	environmental impact assessment
Externality	The unintended real (generally non-monetary) side effect of one party's actions on another party.
FAO	Food and Agriculture Organization of the United Nations
GNP	gross national product
Helsinki Rules	Helsinki rules on the Uses of the Waters of International Rivers, agreed in 1966, and since extended to include groundwater
HRD	Human resources development, i.e., the enhancement of knowledge and skills, plus the creation of optimum development conditions to use these

IAP-WASAD	International Action Programme on Water and Sustainable Agricultural Development (FAO)
ICID	International Commission for Irrigation and Drainage
ICWE	International Conference on Water and the Environment, attended by over 500 participants from over 100 countries and over 80 international governmental organizations and NGOs, and held in Dublin, Ireland, 26-31 January 1992. It resulted in the Dublin Statement.
IHE	International Institute for Hydraulic and Environmental Engineering
Institutions	Organizational arrangements and the legal and regulatory framework – the 'enabling environment' – in which organizations operate. More broadly, institutions include entities, processes and linkages between individual entities.
ILA	International Law Association
ILC	International Law Commission
IPTRID	International Programme on Technology and Research in Irrigation and Drainage
ITN	International Training Network (UNDP)
IWRA	International Water Resources Association
Market failure	A divergence between the market outcome, without intervention, and the economically efficient solution.
NGO	non-governmental organization
O&M	operation and maintenance
Opportunity cost	The value of goods or services foregone, including environmental goods and services, when a scarce resource is used for one purpose instead of for its next best alternative use
Policy	A declared intention and course of action adopted by government, party, etc., for the achievement of a goal.
Programme	A definite plan of intended procedure.
Project	A scheme or undertaking.
Ramsar Convention	Convention on Wetlands of International Importance especially as Waterfowl Habitat, done at Ramsar on 2 February 1971 and signed by 22 European States. It came into force on 21 December 1975.
RBO	river basin organization
Riparian state	A state through or along which a portion of a river flows or a lake lies
River basin	A geographical area (catchment area) determined by the watershed limits of a water system, including surface and underground water, flowing into a common terminus.
Sensitivity analysis	Assessment of the response of some factors as a result of changes in others

Sewage	Liquid refuse or waste matter carried off by sewers.
Sewerage	The removal and disposal of sewage and surface water by sewer systems.
Stakeholder	An organization or individual that is concerned with or has an interest in water resources and that would be affected by decisions about water resources management.
Strategy	A set of chosen short-, medium- and long-term actions to support the achievement of development goals and to implement water-related policies.
UFW	un-accounted-for water, i.e., the volume of water lost through leakage or irregular practices between entering a distribution system and reaching the users.
UN	United Nations
UN/ACC	UN Administrative Committee for Coordination
UNCED	United Nations Conference on Environment and Development (Rio de Janeiro, Brazil, 1992). Also known as The Earth Summit.
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDDSMS	United Nations Department of Development Support and Management Services
Watercourse	A system of surface and underground waters that constitute, by virtue of their physical relationship, a unitary whole and that flow into a common terminus
Watershed	The line separating waters flowing into different rivers, basins or seas. Often used to mean catchment area or river basin.
WDR	World Development Report
Wetlands	Areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water less than six metres deep at low tide.
WHO	World Health Organization
WMO	World Meteorological Organization
WRD	water resources development

Part I

BACKGROUND AND PRINCIPLES

Chapter 1
Introduction

The chapter begins by noting some of the special characteristics of water – physical, social and economic – which make it special, and which make a high degree of government involvement in the sector inevitable. Particular emphasis is placed on the size and scope of the sector, making the point that water involves many other sectors and its use has widespread repercussions. Since some of the results of water use transcend international boundaries, the chapter includes an account of recent international events, notably the Dublin Conference and UNCED, at which governments accepted the need to review policies in the water sector, recognizing in particular its growing scarcity value.

SPECIAL ATTRIBUTES OF WATER

It is commonly accepted that access to water is a basic human right. The Dublin Conference in 1992 asserted that "... it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price." (ICWE, 1992)

Many societies believe that water has special cultural, religious and social values, which marks it off from other economic goods. In many cultures, goals other than economic efficiency influence the choice of water management institutions. Some religions (e.g., Islam) even prohibit water allocation by market forces. However, the focus on water's special status tends to obscure the fact that, in most societies, only a tiny fraction of water consumption is actually for drinking and preserving life. A large portion of urban water is used for convenience and comfort. In the arid western United States, per caput water withdrawal by households frequently exceeds 400 litres per day, about half of which is used to irrigate lawns and gardens. Most of the remainder is for flushing toilets, bathing and washing cars.

The value of water to particular users depends crucially on its location, quality and timing. Its location determines its accessibility and cost. Its quality affects whether it can be used at all, and at what treatment cost. The time when it is available governs its reliability and its relative value for power, irrigation, environmental or potable uses.

In addition, the value of water, especially in agriculture, is inseparable from the type of land to which it is applied, the nature of the soil, its drainage possibilities, etc. Saline water is, for instance, unusable on some soils, but viable on others.

Water has two features that further complicate management efforts: bulkiness and mobility. The value per unit weight tends to be low. Transporting and storing water is costly relative to its economic value at the point of use. In crop irrigation, the water applied may yield additional economic values of less than $US 0.04 per tonne of water. Furthermore it has a long-term value to the sustainability of life and economic activity, over periods that

dwarf those considered in conventional cost-benefit analysis: this *instrumental value* could be thought of as the value to future generations which is hard to quantify and define simply, but includes considerations of quantity, quality, timing and accessibility.

Water is also difficult to identify and measure because it is a fugitive resource – it flows, evaporates, seeps and is transpired. This evasive nature means that exclusive property rights, which are the basis of a market economy, are hard to establish and enforce.

Water projects that attempt to compensate for extreme seasonal variations such as floods and droughts frequently require enormous investments. The economies of scale are such that a single supplying entity is often the most economically efficient organizational arrangement. This is a classic 'natural monopoly.' At the other extreme, most economies of size for pumping groundwater are achieved at relatively small outputs, and multiple suppliers can therefore operate efficiently.

Aquifer management is often complicated by the aggregate impact of the actions of many individuals. Even though each individual may have a negligible impact when taken alone, the sum total can be of major importance. One tube-well has little effect on the total water supply, but thousands of tube-wells can quickly deplete an aquifer. Establishing effective policies to regulate water abstraction by these many small-scale, scattered decision-makers is exceedingly difficult.

THE CASE FOR PUBLIC INTERVENTION

The above characteristics of water make a large measure of public intervention inevitable. Economies of scale in the collection and distribution of water tend towards natural monopolies, which need to be regulated to serve the public interest. The fact that many investments are huge, and have a long time horizon, often discourages private capital, and requires large amounts of public investment.

Water uses in a river basin or aquifer are interdependent, which is to say that users impose 'externalities' on others that they ignore in their own decisions (e.g., discharging polluting effluent into a river causes harm, inconvenience and costs to other river users). In some respects water is a 'public good' in the sense that it is impractical to exclude users or beneficiaries, and therefore impossible to charge for (e.g., improved navigation, flood control, reduced river pollution, etc.). Where this is the case, private investment will not be forthcoming. In both these respects, water is prone to 'market failure,' which implies that some public involvement is called for.

Ultimately, water is vital to life, and certain water systems are of national strategic importance. Governments have a responsibility to manage water for the national welfare. This does not imply that the water system needs to be 100% in public ownership. It does, however, mean that appropriate laws, regulations, institutions and incentives should be in place to guard the public interest, and that governments stand ready to invest where the market will not.

Governments are, unfortunately, subject to shortcomings of their own, and it cannot be assumed that they are always efficient servants of the public good. 'Policy failures' are the public twin of 'market failures', although the sense might be different in the case where, for instance, government applies subsidies to drinking water for public health objectives. The management of water is often fragmented between different agencies and parties, leading to conflict, confusion and mutually damaging tactics.

Water authorities and service agencies are often overextended and inefficient. They often fail to recover enough funds to cover essential operations, and there is often a growing backlog of unserviced consumers. Publicly owned companies and utilities are usually among the worst water polluters, whatever legislation is formally in place.

In short, a well managed water sector needs a balance of public and private involvement, recognizing the limits of both the market and government, and building on what each seems to do best.

THE WATER SECTOR AND ITS OUTREACH

The water sector embraces direct consumption and use of water, land drainage, flood relief, farm irrigation, fisheries, industrial and other abstraction, hydropower, in-stream use of water for navigation, recreation, amenity, wildlife, etc., environmental protection, and disposal and treatment of sewage and industrial effluent.

It follows that decisions about water concern many interested parties – 'stake-holders' – in the sector. The decision to use more water in agriculture, for instance, could have implications for power generation, for municipal use, for industrial offtake, for in-stream uses such as fishing, navigation and recreation, and for the environment, including wetlands, deltas and game parks. These decisions could also entail major public health risks, such as the spread of malaria and bilharzia.

Apart from being the largest worldwide consumer of water, agriculture is also a major water polluter. Saline irrigation off-flows or drainage containing agrochemical residues are serious contaminants for downstream water users. Agricultural nitrate is contaminating groundwater in a number of areas. The disposal of liquid animal wastes pollutes surface and groundwater and is the main environmental problem in some intensively farmed regions.

Conversely, natural resources sectors such as agriculture, forestry and nature conservation can hold the key to improving the management of water resources. Certain kinds of farm practices, for instance terracing and agroforestry, can help to preserve and improve the functions of watersheds. Afforestation and sustainable management of standing forests also have a vital part to play in protecting upland water sources. The more careful use of water by irrigators can release supplies for growing cities, or for hydropower or environmental purposes, while more careful use of agrochemicals and better drainage practices would improve the quality of water for downstream users.

Water has an international dimension where countries share a river, lake, coast or aquifer. The issues are similar to those arising where the resource is of purely national concern, except that sovereignty is involved, international law is applicable, aid is often at stake, and countries may be willing to go to war to defend their interests. There is a serious risk of water becoming a *casus belli* in some of the arid parts of the world.

THE INTERNATIONAL DEBATE

Water, waste management and related environmental issues have been the subject of increasing international concern and debate. The UNDP global consultation on *Safe Water and Sanitation for the 1990s*, held in New Delhi (1990), appealed for concerted action to enable people to obtain two of the most basic human needs – safe drinking water and environmental sanitation. Its guiding principles included protection of the environment and health, institutional reforms, community management, financial strategies and appropriate

technologies. The UNDP symposium *A Strategy for Water Sector Capacity Building* (1991, Delft, The Netherlands), defined the three basic elements of capacity building as creating an enabling environment with appropriate policy and legal frameworks, institutional development including community participation, and human resources development. The international water agenda was broadened further at two landmark conferences in 1992, sponsored by the UN system: the *International Conference on Water and the Environment* (ICWE) in Dublin, and the *United Nations Conference on Environment and Development* (UNCED) in Rio de Janeiro, Brazil. Those two conferences highlighted a number of principles: water must be managed in a holistic way; institutional arrangements need to be adjusted to allow stakeholder participation in all aspects of policy formulation and implementation, including devolution of management to the lowest appropriate level; the central role of women; and the management of water as an economic resource as well as a resource for meeting basic needs.

In 1993, the World Bank (1993a) issued a comprehensive policy paper defining its new objectives for the water sector. FAO recently established an *International Action Programme on Water and Sustainable Agricultural Development* (IAP-WASAD). Likewise, the UN Specialized Agencies, international non-governmental organizations (NGOs) and bilateral assistance agencies are all coordinating or participating in special programmes related to water resources. The *Ministerial Conference on Drinking Water and Environmental Sanitation* (at Nordwijk, the Netherlands, in March 1994) called for strategies for drinking water and sanitation to be developed in the context of broader strategies for sustainable water resources management and environmental protection.

The message highlighted by all these efforts is that water availability is increasingly limited - to the extent that there is no room for sub-optimal management if sustainable economic development is to be achieved. Of principal concern is the failure to recognize and accept that there is a finite supply of water and value it accordingly. The consensus is that the growing water scarcity and misuse of freshwater pose serious threats to sustainable development.

TARGET READERSHIP

This framework is addressed to all those who become involved with reform in water resources management. Some of its contents are addressed to a broad readership, and so will be familiar to water specialists, but is believed that the latter could benefit from the wider introduction placing the water sector in its holistic context.

Chapter 2
Problems and principles

This chapter begins by illustrating the scale of problems in the water sector worldwide, drawing on recent work on vulnerability. The problems of agriculture are specifically dealt with, since this sector is crucial to any solution due to the magnitude of its water demands. A general checklist is introduced to help identify some of the common critical issues facing governments in this sector. Some country case material is summarized to indicate the circumstances which prompted various countries to undertake policy reviews.

The chapter continues by expounding the concept of water as a limited resource – one which is increasingly argued to have the characteristics of an economic good, together with some of the reasons why it is not treated as such. The economically efficient use of water is one of the basic principles recommended for policy review, together with the criteria of efficacy, distributional impact, environmental impact, fiscal implications, acceptability, sustainability and feasibility. Some implications of these criteria for policy reform are discussed, both generally, and for the agricultural sector. The thrust of policy reforms is in line with existing trends in agricultural policy. Some strategic choices and trade-offs are then described, such as inter-sectorial priorities, food self-sufficiency, and international diplomatic issues. Finally, the choices of centralized or de-centralized; of public or private management styles; and of supply-oriented or demand management policies are examined.

GROWING WATER PROBLEMS: THE CONCEPT OF VULNERABILITY

Competition among agriculture, industry and cities for limited water supplies is already constraining development efforts in many countries. As populations expand and economies grow, the competition for limited supplies will intensify and so will conflicts among water users. Whilst the scale of emerging mismatch in demand and supply is unprecedented, societies and cultures have historically often been vulnerable to water with respect to quantity, quality and timing of availability, and in some instances to capture by enemies. Thus competition for and conflicts over water are not new.

While climate is the principal factor in water quantity and its inter-temporal distribution, population and economic development are the main influences on quality and demand.

Although water quality and its inter-temporal distribution are difficult factors to measure for the purposes of international comparisons, the supply and demand for water can be calibrated both between countries and over time, and conclusions drawn about the vulnerability of the region concerned. Care should, however, be taken in the interpretation of data when making comparisons between countries in different climatic zones and different

agricultural practices – for instance, a temperate country relying on rainfed agriculture compared to one using irrigation. The main factors affecting the supply and demand for water are depicted in Figure 1.

When annual internal renewable water resources are less than 1 000 m^3 per caput, water availability is considered a severe constraint on socio-economic development and environmental protection. Table 1 lists the countries where per caput internal renewable water availability is expected to fall below 1 000 m^3 per caput by the end of this century. Most countries facing chronic water scarcity problems are in North Africa, the Near East and sub-Saharan Africa. Countries with less than 2 000 m^3 per caput face a serious marginal water scarcity situation, with major problems occurring in drought years, and water

FIGURE 1
Interrelationships among forces determining a region's vulnerability to water resources.
(Water quality effects are excluded. From Kulshreshtha, 1993)

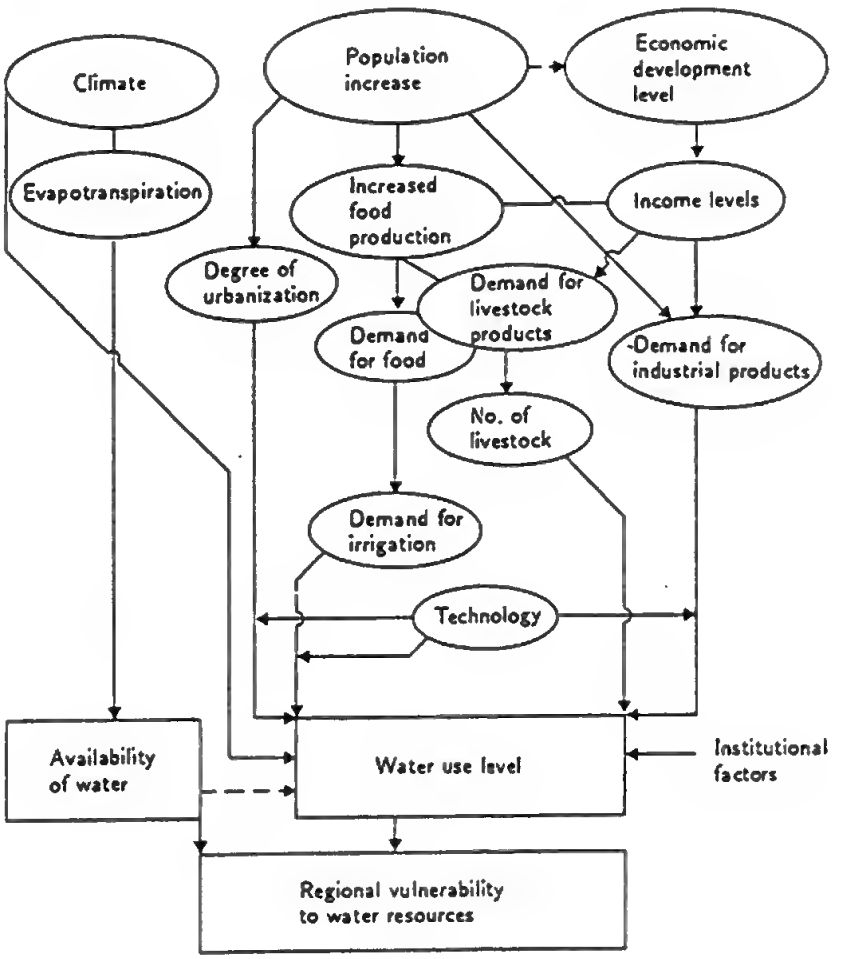


TABLE 1
Water-scarce countries in 2000

COUNTRY[1]	WATER AVAILABILITY m³/person		POPULATION millions
	Internal renewable water resources	Including river flows from other countries	
Egypt	29	934	62.4
Saudi Arabia	103	103	21.3
Libya	106	106	6.5
United Arab Emirates	152	152	2.0
Jordan	153	240	4.6
Mauritania	154	2 643	2.6
Yemen	155	155	18.2
Tunisia	384	445	9.6
Syria	430	2 006	17.7
Kenya	436	438	34.0
Burundi	487	487	7.4
Algeria	570	576	33.1
Hungary	591	11 326	10.1
Rwanda	604	604	10.4
Botswana	622	11 167	1.6
Malawi	760	760	11.8
Oman	860	880	2.3
Sudan	905	3 923	33.1
Morocco	943	943	31.6
Somalia	1 066	1 066	10.6

Notes: 1. A number of countries with smaller populations, including Barbados, Cape Verde, Djibouti, Malta, Qatar and Singapore, are also included in the water-scarce category.
Source: FAO calculations based on World Bank and other data.

availability is expected to fall below this threshold in more than 40 countries by the end of the century (FAO, 1993a).

In many countries, while scarcity is less of a problem at a national level, serious water shortages are causing difficulties in specific regions and catchment areas. Notable examples include northern China, western and southern India, and parts of Italy, Mexico, the United Kingdom and USA.

Despite water shortages, misuse of water is widespread. Small communities and large cities, farmers and industries, developing countries and industrialized economies are all mismanaging water resources. Surface water quality is deteriorating in key basins due to pollution by urban and industrial wastes. Shallow groundwater is polluted from surface sources and coastal aquifers may be irreversibly damaged by the intrusion of salt water. Overexploited sedimentary aquifers are subject to compression and consequently to subsidence. Cities are unable to provide adequate drinking-water and sanitation facilities. Waterlogging and salinization are diminishing the productivity of irrigated lands. Decreasing water flows are reducing hydro-electric power generation, pollution assimilation, and fish and wildlife habitats.

WATER USE AND MANAGEMENT

Water is essential to life and economic activity and its use and management cover almost all spheres of human endeavour.

Domestic water supplies

Provision of drinking water and sanitation continues to be a major humanitarian concern, as, despite the considerable achievement of the International Drinking Water and Sanitation Decade and subsequent efforts, one thousand million people remain without access to safe drinking water and more (1.7 thousand million) do not have adequate sanitation. The public health impacts of inadequate water supply and sanitation also have serious economic consequences for developing countries, which argues the case for the needs of the poor in the face of rigorous application of economic principles. The increasing financial burden on users to pay for water together with sanitation and health has turned water into a central political issue: more than 3 thousand million people worldwide have daily incomes of less than $US 2, which places a severe limitation on their capacity to pay the full economic costs of services.

Aquatic resources versus agriculture and urban development

Inland fisheries have suffered considerable environmental degradation as a result of agricultural intensification and water diversions for irrigation, urban use and flood control. Inland fisheries and extensive aquaculture are non-consumptive uses of water with high value, especially to the rural poor. Water policy reviews and strategies should consider the sustainable exploitation of living aquatic resources and strengthen institutional cooperation between water development institutions and fishery administrations, to identify common interests.

Upland water management

Mountain areas produce 80% of global water resources, whilst they have less than 10% of the global population. Degradation of upland catchments and diminution of their water resources has been attributed by some to the lack of compensation paid by downstream users to upstream inhabitants as guardians of the resource. Policy innovations to address this have been implemented in Colombia, where royalties are paid from hydropower revenues to the upper watersheds. It is important to identify appropriate institutional arrangements to ensure that funds are used for efficient catchment management and this requires a good understanding of customary rights and customary law.

AGRICULTURE - A KEY TO THE PROBLEM

At first glance, many of these water problems do not appear to be directly related to the agricultural sector. Yet by far the largest demand for the world's water comes from agriculture and more than two-thirds (up to 90% by some estimates) of the water withdrawn from the earth's rivers, lakes and aquifers is used for irrigation (World Bank, 1993a). With the growth of competition, conflicts, shortages, waste, overuse and degradation of water resources, policy-makers look increasingly to agriculture as the system's safety valve. Governments' structures and programmes are increasingly being adapted to reflect policy in population and in environment, with water the central issue in reconciling these two concerns.

Agriculture is not only the world's largest water user in terms of volume, it is also a relatively low-value, low-efficiency and highly subsidized water user. These facts are forcing governments and donors to re-think the economic, social and environmental impli-

cations of large publicly funded and operated irrigation projects. In the past, domestic spending for irrigation dominated agricultural budgets in countries throughout the world. For instance, since 1940, 80% of Mexico's public expenditures in agriculture have been for irrigation projects. In China, Pakistan and Indonesia, irrigation has absorbed over half of agricultural investment. In India, about 30% of all public investment has gone into irrigation.

A significant portion of international development assistance has also been used to establish irrigation systems. Irrigation received nearly 30% of World Bank agricultural lending during the 1980s. Spending commitments for irrigation by all aid agencies exceeded $US 2 thousand million annually in the past decade.

Once established, irrigation projects become some of the most heavily subsidized economic activities in the world, both directly and indirectly (taking account of low energy costs for pumping). In the mid-1980s, it was estimated that average subsidies to irrigation in six Asian countries covered 90% of the total operating and maintenance (O&M) costs (Repetto, 1986). Case-studies indicate that irrigation fees are, on average, less than 8% of the value of benefits derived from irrigation.

Despite these huge investments and subsidies, irrigation performance indicators are falling short of expectations for yield increases, area irrigated and technical efficiency in water use. As much as 60% of the water diverted or pumped for irrigation is wasted (FAO, 1990). Although some losses are inevitable, in too many cases this excess water seeps back into the ground, causing waterlogging and salinity. As much as one-quarter of all irrigated land in developing countries suffers from varying degrees of salinization. Moreover, stagnant water and poor irrigation drainage escalate the incidence of water-related diseases, resulting in human suffering and increased health costs.

At the same time, irrigated agriculture is expected to produce much more in the future while using less water than it uses today. At present, 2.4 thousand million people depend on irrigated agriculture for jobs, food and income (some 55% of all wheat and rice output is irrigated). Over the next 30 years, an estimated 80% of the additional food supplies required to feed the world will depend on irrigation (IIMI, 1992) and therefore food security and job creation remain firmly on the international agenda, especially in Africa, and this may still imply considerable efforts in water resources development in specific contexts.

However, although agriculture has received the major allocation, due to public investment and supporting policy and legislation, it is often unable to compete in an economic sense for limited supplies of water. Cities and industries can afford to pay more for water and earn a higher economic rate of return from a unit of water than does agriculture. For the first time in many countries, agriculture is being obliged to give up water for higher-value uses in cities and industries. Irrigators in some areas are now asked to pay for the water they receive, including the full cost of water delivery.

This water dilemma – to produce more in a sustainable way with less water – points to the need for demand management mechanisms to re-allocate existing supplies, encourage more efficient use and promote more equitable access. Irrigated cropping policy has been based on self-sufficiency in staple grains, with particular emphasis on satisfying urban demand at minimum prices. Increasingly, cropping policy is becoming less restrictive and more incentive driven, with cost recovery having a natural corollary of market and price liberalization and greater freedom of choice of cropping system by farmers. Policy-makers need to establish a structure of incentives, regulations, permits, restrictions and penalties that will help guide, influence and coordinate how people use water while encouraging innovations in water-saving technologies.

In the past, supply-side approaches dominated water resource management practices. Water itself was physically managed through technical and engineering means that captured, stored, delivered and treated water. However, the era of meeting growing demand by developing new supplies is ending. In our present-day water economy, resource management is shifting away from the goal of capturing more water towards that of designing demand- and user-focused approaches that influence behaviour.

FAO has identified the following as some of the leading issues (FAO, 1993a):

- National water politics are shifting from *projects* to *policies* – this trend is likely to continue and even accelerate.
- Water can become a test bed for economic reform, liberalization and accountability.
- Given water's scarcity and its value to cities and industry, the water subsector will be less dominated by irrigation, and multipurpose nature will be more widely acknowledged.
- Recognizing irrigation as a *service* with customers and users, and not as a production industry.

BOX 1: CHECKLIST: CRITICAL ISSUES IN THE WATER SECTOR

1. **Supply-demand balance**
2. **Standard of provision**

   Are existing farmers being seriously constrained by the quantity, quality or reliability of water?

   What proportion of the population is not served, or inadequately served, with safe drinking water?

   What proportion of the population lacks safe sanitation and wastewater disposal facilities?

   What are the average levels of water consumption per caput for different segments of the population? How do these compare with other countries in similar climatic circumstances and similar levels of development?

   What is the frequency and incidence of water shortages, breakdowns in treatment facilities, suspension of normal services, or rationing episodes? Is such evidence of systemic crisis more common in certain areas (e.g., poorer neighbourhoods, dry regions) than others? In rural areas, what proportion of wells and pumps is in working order?

   What proportion of the population regularly obtains its water from private vendors? Is there any evidence as to what they pay?

   Is the quality of water provided for domestic purposes adequate? What evidence is there of the incidence of water-related illness? Do households take their own precautions to ensure the safety of their drinking water?

   Do farmers and industrial firms receiving public supplies insure themselves by the development of their own stand-by or supplementary sources?
3. **Economic importance of water sector**
4. **Water quality indicators, including salinity, waterlogging and pollution**
5. **Future supply options**
6. **Efficiency of use**
7. **Financial performance of sector**
8. **International sensitivity and commitments**
9. **Symptoms of conflict**
10. **Structural and institutional change**

- At the level of the irrigation scheme, the process of water policy formulation, assessment and appraisal needs better articulation. Participation and consultation are increasingly important, to include more open groups that are representative of political, technical, managerial and – most importantly – water user interests.
- There is clear need to consult policy groups before policy selection, and subsequently for them to provide feedback and adjustment in the light of experience.
- Resolving problems of self interest in policy groups and the identification of options consistent with the national policy framework, as opposed to measures to protect and satisfy special irrigation interests.
- The need to establish organizational arrangements within the public sector that do not fuse policy and regulatory roles with implementation, such as those resulting when a super-ministry is formed from water, energy and irrigation departments.
- There is a need to identify a broader range of water policy options, so as to have less 'policy-by-crisis' management and more resilience in the face of outside pressures.

CHECKLIST OF CRITICAL ISSUES

In most cases, a water policy review will be undertaken in response to a single overriding – and obvious – issue, some of which are illustrated in the next section. However, even in these cases it will be important not to neglect other aspects of the water situation that may be related to the prime issue, or may be growing in importance. In deciding what emphasis to give the water policy review, authorities may find it helpful to use a general checklist such as that in Box 1, although there may well be other issues to consider in any given context.

It is unproductive to attempt to offer guidance to national governments on how to assign relative weights to different issues. The absolute importance that different governments will place on the respective issues will vary and authorities will need to exercise their own judgments. In general, adverse 'scores' in any of the categories below could be the trigger for a review. Poor signals in most of the categories would indicate a serious state of affairs, underlining a need for urgent action.

A review of the issues in any sector is a sophisticated and, to a certain extent, an intuitive exercise, relying on national expertise, which is often available and equal to the task, but for a variety of reasons may be ignored. Although there is a danger that checklists narrow perspectives and can suggest a 'planning-by-numbers' approach, Box 1 is intended to be illustrative rather than prescriptive, and, for the second of the ten critical issues, provides examples of the sort of detail issues and questions that might be relevant, and similar detail considerations apply to the other critical issues.

BOX 2: WATER POLICY REVIEWS: RECENT CASES

BELIZE. The priority water issues in Belize were declining water quality and fragmentation of water resources management. A water sector review was initiated in a national meeting and furthered by the establishment of an inter-ministerial *Pro-Tempore* Water Commission to prepare draft national water resources policy and give recommendations for institutional and legal arrangements.

CHILE. There was a growing realization that the balance between supply and demand for water was becoming critical, and that water pollution was becoming very serious. The immediate trigger for the review was the Administration's concern about the disproportionate amounts of water tied up in private hands because of existing legislation, frustrating the Government's aim of managing the resource more rationally. Another leading issue was the impotence of legislation to address the disparity between the dry north and the water-rich south.

FRANCE. The background to the 1992 Water Act was a growing imbalance between available resources and a number of competing demands, aggravated by a series of dry years. There were also concerns about the deterioration in the quality of surface and underground water, and the challenge of meeting the quality standards laid down in EC directives.

INDONESIA. Rapid economic growth has caused increasing competition for water among industrial, urban and agricultural consumers. The growing scarcity of water in certain regions and the degradation of water quality were threatening to hamper future economic development, and the Government wished to take a long-term view of its water resources. Different institutions dealt with surface water, underground water and quality. There was little relationship between land use and the availability of water. Little control was exercised over serious non-point pollution from urban, industrial and agricultural users. The time of the review coincided with the Government de-centralization programme and formulation of the long-term, 25-year Development Plan.

LITHUANIA. This former Soviet bloc country was in transition. National water and land resources legislations were being reformed, which prompted a review of national water policy. The policy was related to water quality control, changing agricultural practices and land-use policy, with implications for de-centralization of water administrations and privatization of water works.

MEXICO. The underlying reason for the creation of a National Water Commission in 1989 was the emergence of serious imbalances between the supply and demand for water on a regional scale. There was a particular conflict between urban and agricultural consumption.

TURKEY. With the goal of sustainable and environmentally sound water resources development, the reasons for the national water sector policy review were concern about growing regional imbalance between water demand and availability, and the burden of providing water to cities and irrigation, with changing water uses and excessive investment programmes in the water sector. The main resulting documents and actions were the 1983 Law of Environment, the 1984 Law allowing the private sector to build and operate schemes, expanded in 1994 to cover the water supply subsector, and amendment of the legislation to facilitate transfer of O&M equipment to private users.

UNITED KINGDOM. One of the crucial events launching the United Kingdom on its course of full privatization for England and Wales was a dispute over the financial obligations of the statutory water authorities, specifically the terms on which Thames Water should repay a government loan. Soon afterwards the Government issued a White Paper on Privatization. Another background influence was the anticipated high cost of meeting EC water quality standards and of renovating the nation's aging sewerage system.

YEMEN. The main symptoms of the problems that gave rise to the review were rapid depletion of groundwater and a consequent decrease in food production, and growing conflicts among various types of water user. Underlying these symptoms were problems of the lack of regulation of exploitation of a common property resource, the undermining of efficient customary and tribal systems of control, fragmentation of government responsibilities and institutions, which resulted in two parallel and incompatible draft water bills.

REASONS FOR POLICY REVIEW

Any of the problems in Box 1 might be sufficient to trigger a major review of water policy. Box 2 illustrates factors that were important in starting the process in recent cases and Chapter 11 discusses some of the modalities chosen by the countries to carry out their reviews, and their main policy outcomes.

WATER AS A LIMITED RESOURCE

Despite its widespread scarcity, the majority of societies do not treat water as an economic good or service. If water were treated like other goods it would be priced to at least cover its cost of supply, including storage, treatment and distribution, so as to ensure its continuing availability. The price should also be sufficient to reflect the strength of demand, to encourage its consumption to gravitate towards those placing the highest value on it, provided essential supplies were assured to all.

These conditions are clearly not those in which water is supplied and used in most cases. The water sector is typified by supply-oriented provision, reluctance to make active use of pricing, allocation by non-economic means, and the persistence of low-value usage in important sectors. Although farmers and industrial firms frequently develop their own water supplies, individually and cooperatively, and private vendors are active in many cities, private enterprise in the supply of urban and rural drinking water is an exception rather than the rule.

In most countries, the instinctive response to water stress is to consider supply augmentation, as this has been the basis of development strategies for more than 30 years. Prices are rarely used to allocate water supplies or to actively manage demand, often because subsidized services and supply have been offered, for instance, to promote irrigation. A major problem is that farmers producing staple foods in most developing countries would go out of production if asked to pay the full price, and countries thus deprived of staple foods have no means to pay for the food imports that would then be needed. Hence few have any practicable alternative to subsidizing irrigation. Water pricing is usually seen purely as an aspect of cost recovery, and in many cases (e.g., agriculture) it does not even achieve that. The resulting paradox is that, now, an increasingly scarce resource is subsidized, discouraging conservation or waste reduction. The average tariff in World Bank-financed water projects – probably a better-than-average sample – is only about one-third the average incremental cost of supply.

Water may have been allocated for developmental objectives in the past, in part ignoring economic principles in its sustainable provision, but restraints on public expenditure and public sentiment adverse to subsidies, e.g., in irrigation, is already exerting considerable influence in promoting recovery of operational and sometimes capital costs.

Most authorities respond to scarcity by non-price devices, such as rationing, prohibited uses, exhortation, or cutting-off of supplies. Although these can be effective, they can also be costly and inconvenient to users, and do not take account of the relative value of water in different applications. Consideration of water as an economic good may have benefits in sensitizing managers and users to the cost of providing a service, but treating it as an economic good, or even a commodity, is a policy decision that requires careful consideration of legal, institutional and regulatory implications.

The benefits from using water typically vary widely from one sector to another, as well as within sectors. Variations of up to a factor of 10 or more are common in comparing the value of water for different uses within the industrial and agricultural sectors, and similar

differentials apply in comparing municipal and agricultural use values (Bhatia and Falkenmark, 1992). In general, the highest-value water uses are found in speciality crop production, industrial process use, in-house domestic consumption and some recreational uses. The lowest-value consumption tends to be found in low-value farm crops, industrial cooling, and waste assimilation (Gibbons, 1986). This indicates the scope for increasing the total economic benefit from water consumption by re-allocating limited supplies. However, the costs involved, such as for imports of staple foods, may be beyond the financing capacity of governments. Thus fiscal capacity may be a more decisive factor than economic efficiency.

Another sign of the under-development of markets is the minor role played by private enterprise in bulk supply and distribution. It is no accident that privatization has made least headway in the water sector, and, except in the UK, it has largely taken the form of concessions and management agreements, rather than full-blooded ownership. Arguments for valuation of water as an economic good do not necessarily imply the introduction of markets, as the varied experience in the western states of the USA testifies: the mixed administrative allocation of water in New Mexico (based on assessment of economic value) is considered to be more effective and economically efficient than the market system in Colorado, where enormously expensive litigation has, since 1985, blocked transfers to the Thornton suburban district of Denver (Livingstone, 1993).

Strong vested interests dependent on cheap water conspire to preserve the status quo. Irrigated agriculture, and industries reliant on large volumes of water or cheap hydropower, can exercise great political influence.

Sometimes physical factors hamper the development of a more integrated water market. There may be no practical method of transferring water which is surplus to one sector – or used wastefully – to another which could make more economic use of it. In the neighbourhood of Beijing, surplus agricultural water would need to be collected from groundwater wells and pumped uphill to the city. This limits how much could be transferred.

Physical barriers to the development of water markets are often underscored by legal obstacles, arising from the prevailing set of property rights. Specific users may have legally-defined rights over the use of water, which lapse if they do not use it for the specified purpose. In other cases, ambiguity over the ownership of water prevents its transfer from one customary user to another. The rights of third parties (including the public interest) in water transfer cases is another consideration, and, indeed, is a necessary part of 'internalizing' environmental concerns into the transaction.

Shifting water onto a more market-oriented basis entails transitional costs, which can be heavy. Metering involves a sizeable resource cost, which has to be weighed against expected water savings. Industries may need to spend sizeable amounts on recycling equipment, or even introducing an entirely new, water-efficient process. In households, campaigns to promote water-efficient devices are costly and time-consuming. Socially, ensuring the transfer of water from one sector to another may be disruptive (such as leading to a decline in communities that depend on irrigated farming).

There is also a lack of faith in the efficacy of economic instruments. It is widely believed that the price elasticity of demand is simply too low for water pricing to do an effective job in restraining demand and re-allocating supplies. This view is based on an era when water prices were too low to register as significant by the majority of consumers. A growing body of evidence from both developed and developing countries, principally in the urban and industrial sectors, shows that consumers do respond to water prices where they are set realistically. Where pricing is used actively in agriculture – e.g., for groundwater sales,

and in water transfers – there is evidence that farmers respond as economists would predict (Winpenny, 1994).

PRINCIPLES FOR WATER PLANNING AND ALLOCATION

The Dublin Statement (ICWE, 1992) listed four principles to be applied in water resources management.

1. Water must be managed in a holistic way, taking interactions among users and environmental impacts into account.
2. Water must be valued as an economic good and managed as a resource necessary to meet basic human rights.
3. Institutional arrangements must be reformed so that stakeholders are fully involved in all aspects of policy formulation and implementation. This means that management must be devolved to the lowest appropriate level, with enhanced roles for NGOs, community groups, and the private sector.
4. Women must play a central part in the provision, management and safeguarding of water.

However, a number of other factors come into play in planning and managing water systems, and different countries will place varying emphases on these. These criteria include:

- effectiveness,
- efficiency,
- equity and distributional effects,
- public health,
- environmental impact,
- fiscal impact,
- political and public acceptability,
- sustainability, and
- administrative feasibility.

In particular circumstances other considerations may also be relevant, e.g., impact on food self-sufficiency, regional development, the urban-rural balance, a desire for self-sufficiency in water, etc. These factors and values are briefly discussed below.

EFFECTIVENESS

Water is a sensitive topic in most societies. Reforming public behaviour towards water is an invidious and difficult task, with substantial political and administrative costs. It is therefore important that policies should have a commensurate 'pay-off' in the effective fulfilment of their goals. Efficacy is thus related to the criterion of acceptability, discussed below.

In the case of increases in the price of water, the clearest measure of response is the elasticity of demand in respect of change in its price. There is growing evidence that certain categories of demand are elastic enough, in this sense, for price changes to induce demand responses. Even where demand is price-inelastic (where the amount consumed changes less than proportionately to the price increase), prices can still be successful in reducing consumption, compared to other options for balancing supply and demand.

In many instances, a combination of measures might be most effective. Higher charges for water use might be accompanied by a campaign of public information and

education; subsidies for the installation of water-efficient facilities; and free advice on reducing consumption and waste. The effective control of water pollution could entail the combination of regulations ('command and control' devices) – properly enforced – with 'polluter pays' taxes and charges.

EFFICIENCY

The efficiency criterion requires that the economic benefits of policies exceed their costs. For instance, in the case of the development of new water supplies, the value of the water produced should exceed the costs of production, to which should be added environmental costs. For conservation measures, the reduction in consumption is worthwhile so long as the unit value of the water saved exceeds the cost of providing it. Beyond that point, conservation has too high a cost in terms of benefits foregone (Winpenny, 1994).

Efficiency also applies to policies involving the re-allocation of water between different users, e.g., within the agricultural sector, or from agriculture to municipal or environmental use. Re-allocation to higher-value uses produces net social benefits corresponding to the difference between the value of water in its old and new uses.

EQUITY AND DISTRIBUTIONAL EFFECTS

Policies should be seen to be 'fair' in their respective impact on the various socio-economic groups. Deserving groups, who may be mothers of young children, poor households or small-scale farmers – often single females – previously receiving supplies considered to be inadequate or obtained at high personal or social cost, should benefit from policy reforms, and should certainly not find themselves worse off. It is important that the consumption of such target groups should not be reduced to below socially-desirable levels.

Women and poorer groups in society, with less influence and voice, tend to get low priority in the public provision of water services. Poorer farmers, both male and female, are often at the tail end of irrigation systems, where supplies are unreliable. Poorer urban consumers tend to be last in the queue for getting piped supplies and sewerage. Where conventional policies for water supplies often fail the poor, demand management measures may be helpful. For instance, the poor might pay less for piped and metered supplies, at an economic tariff, compared with what they now pay to private vendors.

A related concern is that more affluent consumers should not receive disproportionate benefits from any policy measures, and that extreme inequalities in water consumption should be reduced.

PUBLIC HEALTH

Despite the achievements of the International Drinking Water Supply and Sanitation Decade (1981-90), over one thousand million people lack access to safe water, and 1.7 thousand million do not have proper sanitation (World Bank, 1992). The backlog is rising in absolute terms.

It has been authoritatively asserted that inadequate sanitation and clean water provision remain the most serious of all environmental problems, in terms of the scale of human suffering (World Bank, 1992). Universal adequate water supply and sanitation would

benefit hundreds of millions that currently suffer from such diseases as diarrhoea, roundworm infection, schistosomiasis, trachoma or guinea worm (World Bank, 1992).

These estimates indicate the importance of public health *benefits* in planning water systems to provide adequate universal coverage of water supply, sanitation and safe disposal. However, there are also public health *risks* implicit in certain water supply schemes, including the creation of malaria vector breeding habitats, the spread of bilharzia in irrigation schemes, or increased pollution from greater water use.

In applying the public health criterion to water supply, there should be adequate recognition of the benefits to national nutritional levels from having adequate food security based on local irrigated farming.

ENVIRONMENTAL IMPACT

The environmental impacts of schemes to supply, use and dispose of water are potentially very large. Dams and reservoirs, aqueducts, river diversions, major irrigation schemes, industrial and municipal offtake, groundwater pumping, etc., can have a massive hydrological impact, affecting other users, future generations, amenity and wildlife, as can the disposal of wastewater and the contamination of freshwater bodies through agricultural runoff, industrial effluent or unprocessed sewage.

These environmental effects should be included not only in the course of project appraisal but also throughout the project cycle, beginning at sector analysis. Environmental effects should be factored into the economic appraisal, either as costs or credits, using recognized techniques (Dixon *et al.*, 1988; Winpenny, 1991). In practice, only certain effects can be quantified, and even those only partially and imperfectly. The environmental effects of policies may also be captured in numbers, and they should be rigorously tracked using recognized checklists (World Bank, 1991).

Environmental criteria apply with particular rigour to large new schemes for water supply development. In contrast, demand-management measures, such as conservation, are much more environmentally benign, avoiding the major impact of supply projects and reducing costs resulting from pollution.

FISCAL IMPACT

Many countries with serious water problems also have weak public finances. The fiscal impact of water policies is an important criterion, both for general macro-economic management and for the proper funding of water and sanitation provision. A sustainable policy would be one having a positive impact on the finances of central or local government, e.g., from a tax, price increase, charge, a reduction in subsidies, or the avoidance of major capital spending. It should likewise benefit the financial position of the water utility, irrigation agency, etc.

The strict application of economic water pricing, based on the 'marginal cost' principle, could even generate 'excessive' revenue for the water utility compared to the alternative of average cost pricing. These revenues could breach allowable rates of return established by regulatory bodies, and could arouse antagonism amongst the general public. In such cases, total revenue could be adjusted by lowering consumer charges unrelated to consumption, e.g., the fixed part of a two-part tariff, or by reducing the price of the first 'blocks' in an 'increasing block' tariff structure.

The fiscal yield of a specific price adjustment depends on the price elasticity of demand. Although elasticities vary greatly for different categories of consumption, most aggregate estimates have values less than 1.0. Where this is the case, tariff increases will increase total revenue.

POLITICAL AND PUBLIC ACCEPTABILITY

It is desirable that policy changes should be acceptable to the parties affected and should not encounter serious resistance in the political process. However, this is a counsel of perfection and there would normally be gainers and losers from any policy change. Nevertheless, the ground needs to be carefully prepared. There should normally be some proportionality between the effort that goes into introducing a policy measure (the sacrifice of political goodwill, expenditure of political credit, the resources involved in steering legislation through, overcoming public resistance and lobbying, etc.) and the pay-off from that policy. A policy that achieves little, but at great political cost and arousing much public antagonism, is clearly undesirable.

A policy is more likely to be acceptable if it is seen to be tackling a severe problem, if its costs and benefits are apparently equitably distributed, if there is a strong lead from prominent political and community figures, if it is accompanied by adequate publicity, and if the population is well informed and public-spirited.

It will be tempting for politicians to steer clear of a policy that relies on major behavioural changes (e.g., introduction of pricing or conservation measures), compared to one consisting of a technological 'fix' (e.g., the development of new supplies). However, the former may be preferable, and in some circumstances may be the only option.

SUSTAINABILITY

Certain policies have a once-and-for-all impact, while others have a continuing or even a growing effect. Short-term measures introduced in response to an emergency, such as a drought, may have a strong immediate impact, but one which tails off sharply when the worst of the emergency is over. Policies which make a long-term impression on water use, such as technological adaptations and changes in user habits, are more sustainable.

Best of all are measures whose impact increases over time, either because their elements reinforce each other, or because they provide incentives for continuing and cumulative effects.

ADMINISTRATIVE FEASIBILITY

The operation of a policy must be within the administrative capability of the department or agency involved. For instance, metering supplies requires a certain level of household visits, and billing staff. A drive for conservation needs to be backed up by qualified staff to advise households, industries or farmers on technology and improved water management and use. By the same token, if they require intensive monitoring and maintenance, supply augmentation schemes are not the easy option they may appear to be.

New policies will be worthless unless their implementation is monitored and enforced. For instance, the system of water transfer practised in some US states requires official approval for each transaction. The control of water pollution implies regular monitoring and

inspection, and a willingness to penalize the offenders. Water pricing requires regular collection of revenue and a willingness to prosecute non-payers.

POLICY REFORM IN AGRICULTURE

Sustainable agricultural development depends on sustainable water use. Governments today recognize that the search for sustainable economic growth requires, in part, both economy-wide and sector-specific policy reforms. Economy-wide policies attempt to create a favourable macro-economic environment while water sector policies, for example, seek to encourage resource efficiency among water users.

The current emphasis on macro-economic policy reforms and economic liberalization has several important implications for irrigation. Recognition of the value of water (and the high cost of turning a water source into a service delivered to a farm) makes the water sector a prime target for further policy reforms. Nonetheless, irrigation remains a resource-hungry sector in this transitional period. Even successful irrigation consumes large quantities of capital and foreign exchange and ties up scarce skilled personnel.

Like many public sector personnel, irrigation managers must walk a fine line between a tighter control of finance, the need for more positive active leadership and better planning of resource allocations, on the one side, and the contradictory need for more ideas from below (farmer customers) on the other. Financial pressures are likely to be the dominant influence. Irrigation as a public sector agency still relies on budget allocations to obtain financing. Many argue that this gives little incentive to save money and may, in fact, have the reverse effect.

As private sector disciplines are applied in irrigation, and more user participation occurs, policy-makers are finding that:

- agencies become more supportive of farmers' own efforts and less inclined to make all key decisions before informing farmers accordingly;
- management seeks more consensus on priorities, more information about the basis of decisions and a common view of external factors affecting management;
- irrigation schemes seek and receive more autonomy;
- the financial responsibilities and accountability of managers increases; and
- managers shift focus from their ministries and governments, depending on the amount of finance generated by service fees. (FAO, 1993a)

STRATEGIC CHOICES AND TRADE-OFFS

Many countries are having to confront the prospect of emerging water scarcity in the long term, and for some that spectre is already upon them. Difficult choices have to be made in many areas, and some of the more important areas are considered below.

Priorities between sectors

Against the background of increasing population, growing food requirements, industrialization and urbanization, the competing claims of agriculture, industry and household water consumption need to be mediated. Other important claimants are hydropower, navigation, flood control, fisheries, recreation and the environment.

Self-sufficiency in food, or water?

A water-scarce country pursuing food self-sufficiency may be forced to import water at some point. If water becomes the scarce factor, it may be more sensible to 'import' it embodied in food, especially if food is available on favourable trade terms. Egypt, a water-scarce country, regularly imports food (Allan, 1992). California obtains 73% of its daily water input by importing food, though it also 'exports' water by selling cotton, fruit and vegetables.

Domestic versus international concerns

The domestic water policies of a number of countries are steering them on a collision course with their neighbours. This applies both to the use of a common river or lake and to the pollution of a shared water body. Upstream users are in a naturally stronger position, and could even use their water policies to exact concessions in other spheres. However, if they press their advantage too far, they face potential international financial and diplomatic sanctions, and ultimately armed force. Downstream users can, by their own water policies, increase their dependence on their upstream neighbours, to their eventual cost.

Management mode

There are many ways of managing national water resources, but one basic choice is between centralized and de-centralized management and control. The former could take the shape of river basin authorities (e.g., France), while the latter could take the form of power vested in a number of regional, urban or functional agencies and utilities doing deals with each other (e.g., California). Political traditions and power structures, and the balance between the centre and the regions, will influence which model is preferred.

Another strategic choice is over the relative roles of the public and private sectors in operating the water industry. Although operation by public departments or utilities is still the norm, an increasing number of countries are privatizing operations. There is the further choice between allowing private companies full ownership of assets (as in the UK) and admitting them as concessionaires, with assets remaining in public ownership (as in France).

A further decision has to be made over management *style*, which polarizes between authoritarian (e.g., irrigation technocracies in some South Asian countries) and participatory (e.g., self-management by community organizations).

Policy mix

Doing nothing, or postponing any changes, is always an option, and may be perfectly rational in some cases, but the costs of inaction should not be ignored. If action is to be taken, a basic choice is between supply-oriented policies and those focusing on demand management.

A further option is the use of 'command and control' measures (regulations, quotas or instructions) rather than economic instruments relying on incentives (prices, taxes, fees or markets). In practice, the choice will be over the *balance* between the two types of measure, both of which are necessary. Indeed there may be good policy imperatives for continuing subsidies in the water sector, even if they change in form and value.

Part II

POLICY REVIEW AND STRATEGY FORMULATION

Chapter 3
Policy review and strategy formulation – the process

This chapter offers a structured approach to a policy review and the formulation of a strategy, providing an organizing principle for material presented in earlier chapters. Starting with an assessment of the importance of water in national social and economic life, it proceeds through a matrix of problems and critical issues, a quantification of pressures, identification of options, the formulation of a strategy, and concludes with the action programme and implementation schedule.

INTRODUCTION

Previous chapters contain material on likely problems, the general principles according to which they should be tackled, and some of the methods and techniques available. This chapter offers an *organizing principle* for carrying out the review, in seven steps. These are listed in Box 3, and elaborated in the remainder of this chapter.

Water policy review and strategy formulation have many overlapping elements and are closely related, and the intent is to offer the different elements that together make up a review or strategy formulation process. It is for the countries to choose those elements that are applicable and most likely to develop a unique process that matches their unique needs. Hence the framework concentrates on elements.

BOX 3: THE STRUCTURE OF WATER POLICY REFORMS

Policy Review

1. Determine the importance of water in national social and economic life.
2. Prepsre a matrix of problems and critical issues.
3. Quantify and rank pressuras on the water resource.
4. Identify options for mitigation.

Strategy Formulation

5. Formulate a water atrategy.
6. Define an action programme and implemantation schedula.

The working definition used in this guide is that strategy is a *means of translating policy into action.* The practical application of the concept of strategy for water resources management varies widely. In some countries, 'strategy' has been deemed to cover every aspect of water resources management from formulating national policies to defining roles

BOX 4: MATRIX OF PROBLEMS AND CRITICAL ISSUES

Problem type	Evidence	Source	Relative importance
Supply-demand imbalance	By sector and/or region. Future trend.	Growth in population, per caput demand, climatic change, overuse of groundwater, etc.	
Level and quality of service provision	Proportion of population now and in the future with no, or inadequate, provision of safe water, affordable irrigation supplies, sanitation and wastewater disposal facilities; consumption per head; reliability of supplies; etc.	Shortage of investment funds; excessively high standards for connections; rapid growth of informal urban settlements; poor maintenance; shortage of funds for proper water treatment.	
Inadequate water quality	Water quality indicators at key sites; incidence of water-related diseases; rising cost of treatment by water users; legal actions; increased salinity; soil salinization; etc.	Growth of polluting industries; spreading urbanization; lax legislation, enforcement and penalties; poor irrigation practices; rising national and international quality standards; inadequate drainage; water-logging; etc.	Use international or historical evidence.
Costs of future provision	Unit costs of projected schemes for supply, rehabilitation, treatment, sewerage, compared to current and past levels; future costs relative to public investment/aid budget; cost of environmental mitigation.	Exhaustion of easy options in the face of growing demand; insufficient examination of alternatives; insufficient demand management; poor cost recovery; etc.	Future date when it is likely to become critical.
Inefficient use	In agriculture: performance measures such as system efficiency, agronomic norms, economic value of water; proportion of UFW in municipal systems; limited spread of water-efficient consumer devices; etc.	Absence of incentives to conserve water; poor system maintenance; low public awareness of water situation; outmoded and inefficient industrial plant; limited access to imported technology; etc.	Comparative rankings and time schedules can be inserted in the appropriate cells.
Growing conflicts among users	Co-existence of surpluses and deficits among regions/sectors; growing shortages in particular uses; competition for limited supplies, e.g., between farming and urban areas; growing environmental stress; litigation over water; civil unrest; development of water markets and transfers; rising price of marginal water supplies; international disputes; etc.	Growing imbalance of water supply and demand; absence of means to settle disputes amicably or efficiently (e.g., laws, consultation procedures, markets, prices); failures of planning and forecasting; etc.	

and responsibilities for implementation to selecting and financing water sector projects. In other cases, strategy has been treated as synonymous with 'master plans' or 'water action plans' that often encompass specific projects. *This guide defines a water resources management strategy as a set of medium- to long-term action programmes to support the achievement of development goals and to implement water-related policies.* This definition of strategy does not necessarily include project identification, ranking or financing; in this sense it is between policies and projects. Strategies might differ in detail at national, regional and sectorial levels, but should be coherent.

DETERMINING THE IMPORTANCE OF WATER

In order to demonstrate the importance of water issues to policy-makers, the general puhlic and key interested parties, certain broad indicators should be made of the relative importance of the water sector. These indicators would also serve to estahlish the case for resources needed for the sector, in competition with the claims of other sectors and other projects.

Useful general indicators include:

- the size and value of water-intensive sectors in the national economy: agriculture, heavy industry, processing, water-based tourism and recreation, navigation, and other sectors sensitive to environmental quality, such as health care;
- the significance of irrigated agriculture to national food security, GNP and exports;
- the cost to the budget and public investment programme of providing and subsidizing water services. The proportion of foreign aid earmarked for the water sector;
- the relative importance of water-related diseases in national health status, and estimates of their economic and financial costs;
- the balance of payments implication of the water sector, e.g., debt servicing of water projects, cost of importing food due to internal water deficit, etc.; and
- the estimated national economic costs of water pollution.

These indicators should both present the current situation, and take a forward look to some relevant future date, say 10-15 years ahead. This is especially important for countries:

- with rapid population growth or urbanization, or both;
- where the balance between sectors is likely to change;
- where changes in housing patterns and consumer taste are foreseen;
- where there is a large backlog of service provision to be made up; and
- where large investments in new supply, quality improvements, or rehabilitating systems are envisaged.

MATRIX OF PROBLEMS AND CRITICAL ISSUES

Drawing on the checklist of critical issues introduced in Chapter 2, a matrix can be devised, containing evidence of the problem, its source and relative importance in each context. Relative importance can be signified on a scale of 1 to 5, where 1 is relatively minor and quite easily managed, and 5 is very serious and can only be tackled with great difficulty or cost, or both. Box 4 illustrates the type of information required and how it could be organized. The problems chosen here are not intended to be a complete or even representative list, since each country will have its own particular set of problems.

This information, especially judgements on the relative severity of the different problems, should be used to compile a short 'hit list' of problems, with their principal causes, ranked in order of importance.

QUANTIFYING PRESSURE ON WATER RESOURCES

Evidence assembled in the matrix would be extracted to produce orders of magnitude of the severity of the water problems, now and at crucial dates in a relevant planning period (between 10 and 25 years in the future). These data would indicate to planners and decision-makers the seriousness of the water situation, from various points of view, now, and how it is expected to evolve in future.

This information can be organized under three headings: physical and hydrological, economic and financial, and environmental, and some of the key indicators are given in Table 2.

TABLE 2
Key indicators for the water sector

Physical and hydrological	Economic and financial	Environmental
Balance between per caput availability and use of water.	Size of water-intensive or water-reliant sectors within the economy.	Water quality indicators in critical locations.
Level (depth) of groundwater in key aquifers.	Reliance of agriculture and food production on irrigation.	Environmental costs of water provision and use (e.g., of dams, water pollution).
	Price of water in free-market conditions (e.g., from urban vendors or in auctions).	Incidence of water-related diseases, and estimates of their cost to victims and for public health services.
	Proportion of the national budget absorbed by water (e.g., operational deficits, overt subsidies).	
	Proportion of public investment programme, foreign aid, or both, accounted for by water investments.	

IDENTIFYING OPTIONS

Having identified the main problems and formed a judgement on their relative seriousness, the next step is to review options available for addressing the most important of them. The policy analysis matrix given in Box 5 (Chapter 4) may be useful for categorizing actions. This matrix envisages actions at four main levels:

- *Planning and analysis* – entailing the creation of data systems and analytical frameworks, which may include strategy documents, water resource assessments, data banks, monitoring systems, modelling and research.

- *Legal and institutional reforms* – including the formation of management structures and regulations. These actions may include the reform of water and land legislation, agreeing water quality standards and passing supporting legislation, the creation of new authorities or systems of coordination, corporatizing or privatizing water utilities, empowering water user groups, setting up a regulatory framework for the private sector, etc.
- *Economic policies* – with the aim of providing a suitable 'enabling environment' for water use. General economic policies should be examined to adjust their effects on water (e.g., farm support, food self-sufficiency, industrial promotion, and new settlement). Specific incentives should be created to persuade users to treat water as the scarce resource it is, e.g., economic pricing, the creation of opportunities for markets and trading, and introduction of pollution charges.
- *Projects and programmes* – such as public investments, information and education campaigns, and programmes to encourage water efficiency.

The choice from this 'menu' of actions should be evaluated against a set of criteria similar to that proposed in Chapter 2, namely:

- efficacy,
- efficiency,
- distributional impact,
- environmental impact,
- fiscal effects,
- political and public acceptability,
- sustainability, and
- administrative feasibility.

OBJECTIVES OF WATER RESOURCES STRATEGY

The aim in formulating a national water resources management strategy is to provide measures to manage the resource in accordance with adopted goals and policies. Developing such a strategy will also test whether these goals and policies are realistic. A strategy should be developed with the idea of the best or most efficient use of existing or emerging resources to achieve goals.

A national strategy need not identify specific investment projects, although it may outline or provide broad directions for an investment programme. A water resources management strategy should emphasize such aspects of water development as the necessary institutional and human resources framework, and should address the medium- to long-term issue of building or enhancing a country's water management capacity. Such a strategy should incorporate the views of water resources stakeholders by including them in the formulation process. Moreover, the strategy should be developed principally by national experts. The final strategy should be a domestic product that encourages the commitment and 'ownership' necessary for sustained economic development as well as for the implementation of the water strategy and the success of individual projects and investments.

A water resources management strategy differs from the master plans that many countries have developed. A master plan is usually investment- or project-oriented; the product of a master plan is often a specific set of investments to be made or projects to be undertaken. Master plans have a role to play in water resources management if they are viewed as an investment plan that follows the accepted strategy, and should be placed firmly

within the context of development goals and key water-related policies. Some of the best plans already do this, but many countries' master plans have not adequately considered the institutional and human resources frameworks that are important in water management. Master plans have often neglected the long-term issue of building a country's water management capacity. Also, many such plans have been developed with considerable expatriate involvement, and capacity-building of institutions and individuals has often been inadequate.

In contrast to master plans, which often take a long time to develop, 'quick assessments' or 'rapid assessments' have been used to justify immediate investments. Quick assessments may be necessary in the short term; they have the merit of rapidly bringing the major unaddressed issues to the attention of decision-makers. One of the most valuable contributions of a quick assessment is the identification of the limits of what is known, but they do not address the long-term issue of building a country's ability to manage its resources in a sustainable manner.

A number of elements in the approach suggested in this framework have been drawn from the experience of countries in formulating water resources strategies and from approaches to (and experience with) country water resources strategies developed by external support agencies such as the World Bank and UNDP. Thus the World Bank's Asia and Middle East and North Africa regions have developed approaches to strategy that emphasize comprehensive analysis and include institution-building and training (World Bank, 1993b & 1993c).

FORMULATING WATER STRATEGY

Each country has a unique set of legal, institutional, economic, social, physical and environmental conditions that influence its water management policies and strategies. While experience worldwide is useful when generating options for action, the solutions to any country's problems must be tailored to its specific needs. The formulation of national strategies for integrated water management can be complex, depending on many factors such as the size and political organization of the country, its hydrological conditions and the diversity of stakeholders. In some countries in the Middle East, Africa and Central Asia, water scarcity is the main issue whereas floods may be equally or more important in Asia, North America and South America. Pollution is the chief problem for much of Central and Eastern Europe.

Strategy formulation in context

Strategic planning is essentially a continuous process: development objectives and policies exist or are reviewed and after consideration of the relevant issues, options for implementing policy become evident. Selection of a particular strategy then leads to the implementation of funded programmes and projects, whose performance must be assessed. The feedback from performance assessment may then modify strategy accordingly. Part of formulating a strategy should be to specify the entity that will be responsible for monitoring or following-up the implementation of strategy. Depending on the country, this entity might be a professional think-tank, outside experts or a standing committee. It is important that this entity has both the authority and capability to oversee implementation of strategy and that the commitment to review progress is not just a paper exercise.

The need for capacity-building

There is mounting evidence that, in the near future, the major constraint to water resources development and protection will be the limited capacity of the institutions in many countries to absorb financial resources and convert them into worthwhile and sustainable actions and projects (Alaerts, Blair and Hartvelt, 1991). Capacity-building (cf. Chapter 5) is a major aspect of formulating a water resources management strategy. The Delft Declaration (IHE/UNDP, 1991) identifies the three basic elements of capacity-building as:

- creating an enabling environment with appropriate policy and legal frameworks;
- institutional development, including community participation; and
- human resources development and strengthening of managerial systems.

Many failures in water resources management have resulted from lack of trained staff and weak institutions. Capacity-building has been identified as the missing link in African development (Jaycox, 1993).

Real long-term success in water resources management depends on the ability of nationals to identify problems and formulate and implement policies and strategies. Countries constantly need to adapt their policies and associated strategies to new circumstances and challenges. To build capacity, the *process* of formulating a water sector strategy is perhaps as important as the resulting strategy. The outcomes of strategy formulation may be improved in the future; the immediate and difficult challenge is for the government to both make the commitment and put in the effort to develop its own strategy.

Stakeholder participation

Too many development strategies, whether in water or in other areas, have not fully involved the people affected by them (see Sandstrom, 1994). Stakeholder participation (cf. Chapter 6) should involve those who are concerned with or have an interest in water resources and who will be affected by outcomes of policy and its implementation. It is similar to the idea of community participation in decisions at a project level. Decisions regarding water resources can affect nearly every sector of the economy and the public as a whole, and stakeholder participation should be established in a form that will elicit responses at appropriate levels from those concerned.

Experience with stakeholder participation in developing countries is largely limited to community-level projects with external aid financing, such as village-level water and sanitation committees, and water user associations (WUAs) in irrigated agriculture. It is very easy to underestimate the time, effort and finance required for successful animation of such initiatives, and requirements of national-level programmes are likely to be even more demanding. The Australian public consultations on salinity and catchment management were underwritten by substantial federal budgets, to an extent which may not be possible in many developing countries.

The strategy formulation exercise could fail to win public support and necessary political and financial backing if it is perceived as merely an exclusive and technocratic task without the involvement of key constituencies – including professional associations, private-sector agencies, and NGOs. The press and media are important channels for raising public awareness of issues and options in water resources management (UNESCO, 1987).

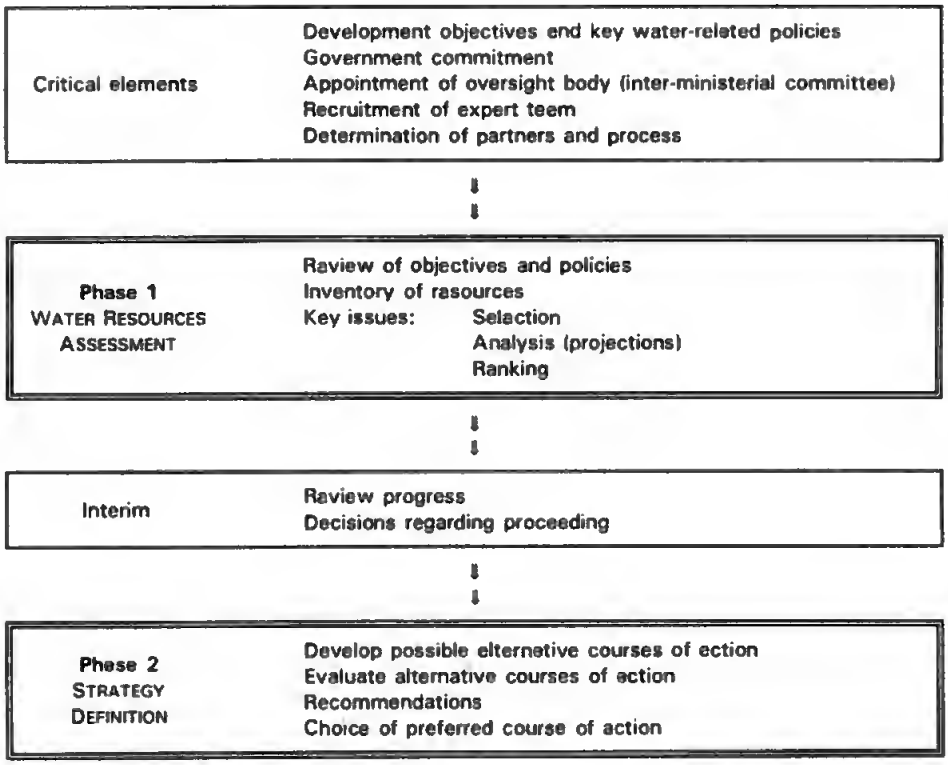
Many governments and development institutions understand that participation will lead to effective development, although one of the risks is over-politicization of issues (technical

or non-technical). Some technical issues might be better left to the expert team or its advisers, particularly in the early stages of strategy formulation.

Process of strategy formulation

An outline showing the stages and the main critical elements in the process is given in Figure 2 and discussed in the following sections. While it is important that policies be in place to guide the formulation of strategy, the iterative nature of strategy formulation means that policies both guide the process and can be revised by it. During either Phase 1 or Phase 2, or even after a strategy has been adopted, policies may need to be adapted or clarified. The options presented to decision-makers may include revising impractical or unrealistic policies.

FIGURE 2
Key points in water strategy formulation



Critical elements

Several elements are critical for successful strategy formulation.

- At the highest levels, the Government must commit itself to the process of formulating a water strategy and to water resources management using an integrated approach. This commitment can take various forms – for example, the head of state or senior Government leaders endorse the approach in a declaration or written statement.

- The government should appoint an oversight body – an *inter-ministerial steering committee* or other high-level authority – to whom the team of experts responsible for strategy formulation should report.
- The government should recruit a team of national experts to be responsible for the process and content of strategy formulation.
- The expert team determines the partners and the process for strategy formulation and agrees with its oversight body on appropriate terms of reference.

Government commitment should also entail the commitment of resources to undertake what could be a long process. While some external technical assistance and other support may be available, a substantial portion of these resources should be furnished by the country itself. The government should also make a commitment that the process will be collaborative, consultative and transparent. *Collaborative* means generating a sense of partnership among key stakeholders within the country and the invited external support agencies that are willing to assist. *Consultative* means fostering debate and discussions among stakeholders on the issues and options that arise in formulating strategies. *Transparent* means both that the process itself should be articulated and that communication through periodic public reports on progress should be encouraged.

The Oversight Body and the Expert Team

An inter-ministerial committee is a desirable oversight body as, too often, the work of developing water resources plans has been left to one ministry without the genuine participation of other areas of government. What matters is not so much the structure, as that strategy formulation has a genuinely inter-sectorial, multidisciplinary approach that can be implemented successfully. Responsibility for final selection among the options presented and for oversight of strategy formulation should be made explicit at the beginning of the process.

The budget for strategy formulation should be designated in general terms prior to choosing a team of experts. Government will no doubt wish to analyse the costs of preparing a water resources management strategy before committing the necessary funds. While estimates can be made, the budget will probably not be finalized and committed until the team has agreed with its oversight body on the work to be done.

The size and composition of the *expert team* will vary according to the terms of reference, which will depend on the size of the area to be studied, the complexity of the water resources issues to be addressed, and the quality and level of the existing knowledge. Members of the expert team should be chosen primarily for their expertise, professional competence and ability to appreciate cross-sectorial water issues. The members should be drawn from a variety of institutions that may include government, public and private agencies, academic institutions, professional associations and NGOs, including user groups. The team may include members of the public, foreign technical experts and other interested parties.

Depending on the political structure of the country, the inter-ministerial committee may wish to keep the parliament or legislative body abreast of the progress with strategy formulation, particularly if funding or governmental issues are at stake.

Determining the partners and the process: Preparing Terms of Reference

Terms of reference for the national expert team should be prepared before beginning the water resources assessment that constitutes Phase 1. The supervisory body or inter-ministerial committee will probably have a general idea of the work to be done, even before

the expert team is selected; the final terms, however, should be prepared in consultation with the team members after they have had the opportunity to suggest the scope and process of the work and to determine the resources they will require.

The expert team should determine the partners and resources it will need and the process it will follow. Partners who will be involved directly in the process include government departments, consulting firms, university faculties and professional associations. In choosing partners, the expert team will no doubt wish to avoid charges of bias; on the other hand, the choice of water resources expertise may be limited. Some guidance on these items will doubtless come from the expert team's oversight body. Tasks in this area include:

- identifying partners,
- identifying and meeting stakeholders,
- defining stakeholder roles,
- determining the work management structure, and
- agreeing on and communicating work and consultation procedures and a work programme.

Determining the work management structure involves defining the tasks, structure and schedules to be followed in the process. There are many guidelines upon which the team can draw to define their tasks (see Tiffen, 1991; WMO, 1992; UNDP/IHE, 1991; ESCAP, 1989; UNESCO, 1987). The expert team may wish to form *ad hoc* or standing groups to cover various specific issues, and should be able to draw on necessary expertise or resources within the government or elsewhere.

Key areas to be considered in the formulation of strategy - listed here and discussed in detail in Chapters 5 to 10 - are:

- institutional and human resources arrangements;
- stakeholder participation;
- information systems;
- economic aspects;
- environment and health; and
- international arrangements.

Phase 1: Water resources assessment

The water resources assessment (Phase 1) is an examination of the physical aspects and wide variety of factors that influence the development and utilization of water resources. It starts with a full appreciation of the stated policies and the existing and on-going developments, and involves preparation of an inventory of water resources and water use, as well as the administrative, institutional and legal factors outlined above. Although this phase may seem to duplicate the assessment done in policy review, it will involve greater levels of detail and be the point of departure for incorporating the stakeholder viewpoints that should form a major part of the feedback on the effectiveness of policy and of the stated objectives in national water management.

It is important to understand the natural environmental systems yielding water and this understanding should be woven into the resource assessment. Ideally, this understanding improves continuously over time as monitoring and analysis continues, driving policy changes and models of water utilization. The emphasis given to policy development and policy reform is a reflection of the decline in monitoring and analysis in many developing countries, due to budget and capacity constraints. As monitoring declines, water resources issues disappear from the political agenda and policy innovation stagnates, as the planning process breaks down.

In some cases, international considerations will dominate the process of formulating a water resources management strategy. Countries need to establish collaborative arrangements with other states influencing (or influenced by) their decisions on water resources management. It may be impossible to proceed without international discussions or contact under the auspices of the expert team. Since resource assessments should be made on the basis of a whole river basin or drainage area, it may be appropriate for several countries to undertake a joint water resources assessment.

Review of policy goals

This was discussed earlier, and is considered in further detail in Chapter 4.

Preparing an inventory

Most water resources developments are long term, extending over 20 to 40 years or more, and transitions occur slowly. This is particularly important for irrigation, where existing arrangements are often a firmly established part of the local culture and the economy of a region. A detailed appreciation of the existing water resources management system, including the manner in which organizations function and the standards of service provided to the users, will help the expert team to understand the main issues and the paths and time any changes will take. This involves collecting information and experience in five key areas – water-related data; institutions and human resources; the economics of water; the environment; and international water affairs. The process of preparing an inventory generates lists of the major water-related issues.

The preparation of an inventory of such information and experience should highlight major issues to be addressed and any gaps in existing information (see Box 1, in Chapter 1). Data on the actual physical resource (its location, quantity and quality) are fundamental to a water resources assessment: the expert team could begin the inventory by examining the availability and quality of data on water supply and demand. This might start from hydrological, meteorological and water quality data, and should be done for each major river basin. Far from merely generating a physical description of the resources or a checklist of available data, the inventory should examine how data are collected, stored, disseminated, analysed and used. Among institutional arrangements, the expert team will probably wish to review existing laws and regulations and the organizational arrangements for implementing them. For example, studies might involve identifying those institutions (or the lack of them) responsible for resources planning, pollution enforcement or O&M of irrigation systems. In the area of economic analysis, the team should study how water and its delivery is priced, the quality of demand forecasts and the analytical techniques used in pricing and economic analysis. The environmental and health aspects of water resources might include an inventory of the state of major drainage areas and sensitive ecosystems, as well as the incidence of waterborne diseases. Finally, the expert team will probably wish to briefly catalogue and evaluate international treaties and arrangements.

All of the elements of water resources management mentioned in the paragraph above have institutional and human resources aspects, such as whether organizations exist that can implement policies, whether they are public or private, or how they function.

Selecting, analysing and ranking issues

Phase 1 concludes with selection and analysis of the major issues to be addressed in the water sector. At the inventory stage, major issues will naturally present themselves, but the analysis should refine them at the local (basin) and national or international levels. Selection of key issues is crucial if strategy formulation is to remain a manageable activity. In the case

of international waters, it would be useful to identify priorities to be handled at the country level, and those that would require dialogue with other countries.

Major issues may need to be addressed in different time frames. Some issues need to be addressed quickly, before they become catastrophes. These issues may include the construction of dams or flood protection, dike safety, over-pumping of groundwater, resettlement practices or dangerous pollutant levels in drinking water. Other issues, if not addressed in the strategy formulation, will jeopardize sustainable development and may cause substantial damage to the environment. These include groundwater contamination by pollutants or saline intrusion; soil salinization; erosion; and spread of waterborne diseases.

In the course of analysing major issues, it may be useful to develop both quantitative and qualitative projections for the demand and supply of water; from these, a number of other needs, such as the demand for a variety of services in the water sector, can be inferred. The projections should reflect the dynamic nature of potential water demand, and stakeholder participation can help make projections more realistic. Hydrological and meteorological factors, population and economic growth, urban development, diversified agriculture, water pricing policies, environmental allocation, changes in technologies and improved demand management are all factors that can affect the nature of water supply and demand.

Indicative projections are normally sufficient to identify trends in water use and supply, and may highlight issues or help to rank them in order of importance. It is important that the expert team set limits on the amount or complexity of the projections. In many cases, basic forecasts already exist.

Qualitative or descriptive forecasts should be made to cover basic views of what the future will be like, or how it will be affected by impending socio-political developments. For example, the expert team might postulate the effects of trade agreements on water resources issues. Such agreements may cause shifts in agricultural production that will change the characteristics of demand for water and attendant products and services. Another example is a change in the domestic legal or administrative environment, such as de-centralization or privatization of water services. Sensitivity analysis can be a useful tool in attaching quantitative values to qualitative changes affecting water resources management.

The final task in Phase I is ranking key issues in order of importance and will help the expert team focus on developing a variety of options that may cover several issues at once.

An interim stage

Review

It is useful to review the process at this point. If there are gaps in data or serious conflicts among stakeholders, remedial action may be necessary before moving on to selection of strategic options. In some countries, completing Phase I can lead directly to formulation of strategic options. In others, particularly in larger countries with many big river basins and complex institutional arrangements, or where international waters are involved, water management strategies may require further and more detailed work.

Conducting Review Workshops

At the end of Phase I, a series of workshops could be organized to evaluate the outcome of the assessment, to review progress and to plan the next steps. Participants could include the country's decision-makers, key stakeholders, members of the expert team, and representatives

of external support agencies. In cases where the country is ready to proceed with the second phase, specific terms of reference could be agreed at the workshop.

Phase 2: Formulating possible alternative courses of action

During Phase 2, the expert team develops and evaluates alternative courses of action and presents recommendations to decision-makers. The actions chosen constitute the water resources management strategy.

In developing and analysing options and in making recommendations, the expert team must strike a balance between the ideal and practical forms of water resources management for a country. Without becoming overly concerned with political ramifications, the expert team should nonetheless be acutely aware of the feasibility of recommendations.

Developing options

On the basis of the work done in Phase 1, the expert team should have identified the major water resources issues or problems to be dealt with in order to implement water policies. Issues can be ranked on the basis of physical, institutional and human resources options. For example, if further development of groundwater resources is an option to satisfy growing urban demand, the complementary institutional and technical arrangements must be developed. If pumping more groundwater is the best solution, the expert team should consider who should develop the resource, who should regulate, and whether adequate environmental safeguards are in place. In short, the institutional and human resources options are necessary adjuncts to any technical or physical options.

Evaluating options

Feasible options should be compared on technical, sociological, environmental and economic grounds in order to arrive at recommendations. Evaluating options, both technical and institutional, should involve analysis of the costs and benefits of each alternative. In this process, the extent to which options respond to original policy objectives should again receive attention. At this point, as in Phase 1, analysis may show that some policies are unrealistic or unmanageable.

Evaluation presupposes established criteria which should be quantitative and as succinct as possible. Criteria used to choose between administrative options for management of water supply might include cost, the quality of service that could be provided immediately, and acceptability to water resources stakeholders. Evaluation needs to consider the necessary inputs to achieving a strategy, their availability and the likely outcomes and consequences of a particular strategy. This should include cultural, ideological and legal issues.

The options should consider various means of matching supply and demand, and of satisfying environmental concerns. The strategic options should include:

- broad technical arrangements needed to meet physical development of water resources;
- institutional and human resources arrangements, highlighting the potential for involving water users, NGOs, professional and trade associations, private-sector service providers and local governments. (Criteria might include reducing the load on the public sector or minimizing the need for complex inter-agency coordination);
- requirements for, and alternative means for attaining, capacity-building in institutions and enhancing skills for water-sector management;
- use of enforceable regulations or revision of inadequate ones;

- demand management possibilities, including the use of (a) pricing and non-pricing instruments, (b) appropriate technologies for water delivery, conservation, re-use, and pollution control, and (c) innovative educational means of motivating present and future users of water to monitor consumption and conserve water; and
- environmental and health protection measures, in particular regulations concerning the monitoring and management of surface waters and groundwater, pollution control in all water subsectors, and incentives for wastewater re-use.

The expert team might wish to give an indication of the broad economic efficiency of each option and an indication of its multisectorial effects. Finally, evaluating the options should include careful consideration and mention of the risks involved. For example, formalizing water use rights and legalizing water trading may raise the potential for monopolization of water supplies and may exacerbate inequitable access in rural areas. Some measures might be suggested to lessen such risks, whereas others may be an 'accepted' consequence of necessary change. It may be appropriate to present the draft strategy to stakeholders, gauge the response and incorporate suitable modifications and alternatives.

Recommendations

On the basis of evaluations and with due consideration of political and economic realities, the expert team will provide a list of recommendations. The inter-ministerial committee (or another authority empowered to do so) will eventually choose among the options presented. These choices will constitute the strategy, which should include the nomination of the body which will oversee its implementation.

Selection of options

The urgency of water resources management reform notwithstanding, it will probably take some time for a government to make choices and allocate resources to implement the strategy. Debate in the legislature or discussion among executive departments will no doubt prove a lengthy but necessary process.

Water resources strategy assistance

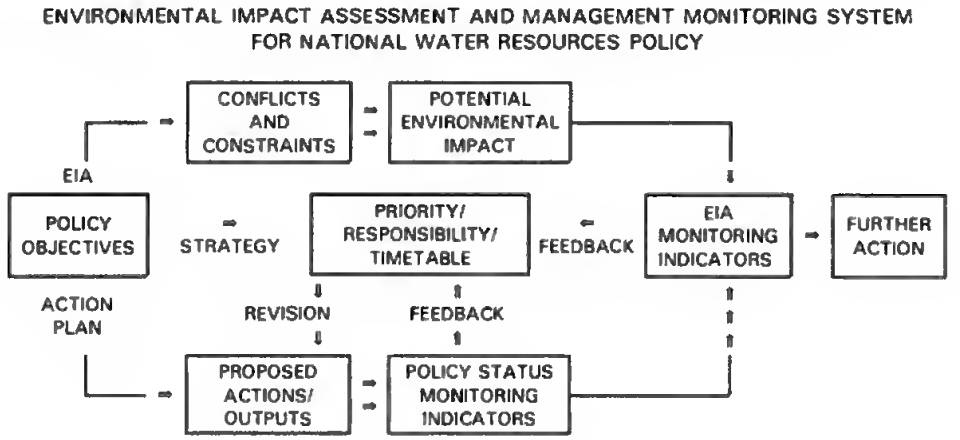
Individual developing country governments or their agencies may wish to seek external support in developing a strategy for water resources management. Technical expertise may be required at a variety of levels and across sectors, but it is desirable that any outside support be primarily focused on assisting the host country to develop or reinforce its internal planning and management capability.

DEFINING AN ACTION PROGRAMME AND IMPLEMENTATION SCHEDULE

This final step should be taken once it is clear from the foregoing what the strategy is, what needs to be done, and what the mixture of policies should be. However, it is difficult to measure the impact of broad-based policies, especially if the strategy and resulting programmes and projects are not implemented as proposed due to changing needs and priorities. Continuous monitoring is clearly an essential part of the ongoing, dynamic process of strategic planning. Environmental impact assessment (EIA) is an increasingly important area of monitoring, which may result in substantial modifications to policy and strategy if unforseen outcomes emerge. Effective routine monitoring and information management allows more of a preventive as opposed to a reactive process, allowing earlier and less costly correction of problems. A preventive and more flexible approach will also facilitate acceptance and approval of the proposed action programme.

No matter how well conceived the action programme may be, negative impacts might arise through interaction between water policy and other national policies; similarly it is conceivable that policies in the various sectors may be in conflict with each other politically, financially and instrumentally. An example of the interaction between a policy monitoring plan and an EIA is shown below, in Figure 3.

FIGURE 3
Diagrammatic interaction between a policy monitoring plan and EIA (Based on Feld, 1994)



Part III

STRATEGY FORMULATION

The elements

Chapter 4
Formulation of a strategy - the elements

Based on the process presented in Chapter 3, this chapter introduces the main elements of developing a water resources strategy. The elements are discussed in individual detail in subsequent chapters. It begins by stressing the value of a holistic approach – and goes on to introductory sections on information gathering, forecasting, modelling, integrated planning, natural resource accounting, and Policy Analysis Matrices, legal and institutional reform and economic measures.

Under the sub-heading of projects and programmes there is a discussion of how the appraisal, selection and design of projects must adapt to the needs of a new strategy, with sections on cost-benefit and cost-effectiveness analysis, environmental assessment and financial management.

A HOLISTIC APPROACH

ICWE (1992) and UNCED (UN, 1992) both called for a new approach to the assessment, development and management of freshwater resources. The proposed approach involves the management of freshwater as a finite and vulnerable resource and the integration of sectorial water plans and programmes within the framework of national economic and social policy.

A more integrated and broader approach to water sector polices and issues is important because of water's special nature as a unitary resource. Rainwater, rivers, lakes, groundwater and polluted water are all part of the same resource, which means global, national, regional and local actions are highly interdependent (Rogers, 1992). Water use in one part of the system alters the resource base and affects water users in other parts.

Water policies, laws, projects, regulations and administrative actions often overlook such linkages. Governments in general tend to organize and administer water sector activities separately: irrigation might be under one department; domestic water supply and sanitation overseen by another; hydropower activities managed by a third; transport supervised by a fourth; water quality controlled by a fifth; environmental policy under a sixth; and so forth.

While they may reflect political realities, these fragmented bureaucracies make uncoordinated decisions, according to individual agency mandates that are independent of each other. Too often, different groups of government planners develop the same water source within an interdependent system for different and competing uses. This project-by-project, department-by-department and region-by-region approach is no longer adequate for addressing water issues.

A more integrated approach to assessment and planning obliges water managers to understand not only the water cycle (including rainfall, distribution, ground and surface water interaction, ecosystem interactions, and natural environment and land use changes), but also the diverse inter-sectorial development needs for water resources.

BOX 5: POLICY ANALYSIS MATRIX

Action categories	Components	
1. PLANNING AND ANALYSIS		
Objectives: to collect data on the water sector; to analyse it in the light of national water needs; to formulate a national water strategy.		
Analytical framework	National water strategy	Demand projection
Information systems	Water resources assessment Data banks Monitoring systems Models Research	Time scales
2. LEGAL AND INSTITUTIONAL		
Objectives: create the right 'enabling environment' for the strategy; set up a legal framework in which rights and obligations in respect of water are clear and which facilitates its rational use; set up institutions and management responsibilities consistent with the strategy; ensure appropriate regulations are in place.		
Legal framework	Laws clarifying ownership and rights	
Institutional reform	New authorities Coordinating bodies Responsibilities of utilities Privatization	
Management structures	O&M reviews Delegation, user groups	
Regulations	Water quality Environmental standards Regulation of private sector Abstraction	
3. ECONOMIC REGIMES		
Objectives: to ensure that macro-economic and sectorial economic policies support the water strategy; create specific incentives for the careful use of water.		
General economic policies	Agricultural support Food self-sufficiency Industrial promotion New settlement	
Incentives	Prices Conservation Markets Trading Pollution charges	
4. PROJECTS AND PROGRAMMES		
Objectives: to select, appraise and design projects and spending programmes systematically, and consistent with the national strategy.		
Public investment schemes	Project appraisal	
Water efficiency programmes	Environmental assessment	
Information campaigns	Financial management	

CATEGORIES OF ACTIONS

In keeping with the holistic approach to the water sector, the various kinds of actions can be grouped into four main categories: planning and analytical; legal and institutional; economic; and project and programmatic. Generally speaking, a water policy review will entail some actions in all these categories, but the balance of activities between each category will obviously vary from country to country, as will the detailed measures taken. These categories, which subsume the key elements of developing a water resources strategy, and details of some of their respective components are illustrated in Box 5, and further discussed in this section.

PLANNING AND ANALYSIS

Methodologies and tools for water policy analysis

There is a danger of water policy reviews being 'technique-driven'. Certain methodologies – particularly those drawing on large data sets and entailing modelling and optimization simulations – are attractive to professionals and allure policy-makers because of their quasi-scientific basis. However, rather than the sophistication of a method it is more important to ask about its relevance to the specific objective in hand, and its credibility in particular social, political and economic contexts.

Data requirements

Water policy formation is very data-intensive. However, data on water supply tends to be poor, while information on demand is often based on gross estimates. This means that the construction and interpretation of, for instance, water supply and demand balances needs great care.

Hydrological information on water supply and water-quality is expensive to obtain and interpret. The repercussions of major new structures and works have to be meticulously examined. The needs and attitudes of consumers have to be ascertained, by survey in some cases. However, data gathering should not become an end in itself. Decision-makers should always ask, "What is this information for?", and, "Is this the most cost-effective way of obtaining it?"

There are two main sets of information to be established to provide a baseline for policy making, planning, implementation and monitoring of the results, namely, an inventory of resources (location, quantity and quality), and an inventory of current diversion and in-stream uses.

Because of the size and longevity of many investments in the water sector, it is essential to take a long view of trends in the sector. *Forecasting future requirements* would normally mean taking 25-50 year scenarios of supply and demand. Extrapolating current and recent trends in demand is pointless if these are unsustainable, and if changes in behaviour are likely to be called for. Hence demand projections need to be *iterative*: if the first few demand-supply scenarios are clearly unworkable, scenarios including demand management and price elasticities should be introduced. In most cases it is unrealistic to assume unconstrained demand for water.

Obtaining the information

Box 6 summarizes key questions to ask about water data.

BOX 6: CHECKLIST OF QUESTIONS ABOUT DATA

- How is access to the required information to be obtained? Are the owners of data obliged to divulge them? If not, how can they be persuaded to cooperate? Where information has to be bought, what is the cost, and what is the most cost-effective way of obtaining it?
- What are the minimum information requirements and how is information to be managed and disseminated to those who need it?
- What standards of information quality are required and how are they to be achieved?
- What requirements are there for simplification and condensation of information for policy making and planning?
- How is additional information gathering and monitoring to be planned, financed and implemented?

MODELLING

Modelling is a useful way of throwing light on problems important to policy-makers, such as the sustainable yield of an aquifer, long-term supply-demand scenarios with water pricing, or optimizing the use of a reservoir serving different users (power, irrigation, flood control, amenity, fishing, etc.). Models are useful for exploring options, but the absolute accuracy of their output is frequently open to question for a number of reasons: inadequate, incomplete or inaccurate data; inadequate description of physical processes within the model; or idealized assumptions about the limits, boundaries and nature of the processes being modelled. It is also naive to think that models can produce generally applicable policy solutions since they are only as good as their underlying assumptions about laws, institutions and consumer behaviour – to cite three examples which are rarely incorporated. The same objections can be made to excessive reliance on integrated planning.

Models can be physical, descriptive or conceptual and describe environmental or economic processes, or combinations of the two. Conceptual models are perhaps the most useful in the planning process, and point the way to worthwhile physical model studies

Physical models range from lumped parameter (black box) models which use simple empirical equations to represent key relationships at a large or 'lumpy' scale – for instance catchment runoff. Physical-based models are intended to capture the complexity of a water system, and are very data intensive.

Economic models aim to represent the balance of supply and demand in a system. If price and demand elasticity are introduced as variables, future scenarios can be generated that may be useful for policy and investment purposes. Another use of models is to optimize the distribution of water between different purposes, by generating its value in different uses. Multi-objective models, such as linear programmes, have been popular in trying to find optimal solutions on economic, technical and other grounds, and help prioritize options for management and policy development.

LEGAL AND INSTITUTIONAL REFORMS

Legal reform

In order to formulate a legal system appropriate to water management, a series of steps and actions is called for, comprising:

- collection of all the legislation in force on, or related to, water resources development and management;
- analysis of such legislation and assessment for consistency with the policy options under consideration; detecting issues pertaining to established individual and communal rights and governmental powers; assessing the required adjustments in such rights and powers; and assessing the legislative drafting required to implement the new policy;
- drafting, implementation and enforcement of any new legislation required.

It is first necessary to consider whether the proposed policy is consistent with existing legislation governing or regulating the use, development and conservation of water resources and other related natural resources (e.g., land, forest, fish) and the environment. If it is not, the next step is to consider what legislative changes will be required, and at which hierarchical level of lawmaking (i.e., constitutional, Act of Legislature, Government regulation). Legal reforms and water rights issues are discussed in more detail in Chapter 5.

Reorganizing the water sector

There are four main approaches to reorganization of the water sector to improve its administrative and operational capacity and improve service and accountability.

- De-centralization and restructuring within the existing public agency.
- Devolution of authority and ownership, to private, commercial and private, not-for-profit organizations such as NGOs, of component parts of the public agency and its support services. Devolution to user groups is widely practised in the irrigation sector.
- Corporatization – turning public sector agencies into financially and administratively autonomous agencies, still within the public sector.
- Privatization, including de-monopolization, franchising, partial sale as a mixed enterprise, divestiture and liquidation.

Internal reforms to improve service can include training to improve professional capacity, financial and career enhancing incentives to improve productivity and the imposition of rigorous and transparent accounting procedures with external independent audit.

Water utility reforms would require them to behave more like commercial undertakings. This will require them to adopt more active pricing, metering and tariff restructuring, improved cost-recovery, and greater self-financing. This will often entail managerial and organizational reforms. Drawing up corporate plans (*contract-plans)* with the government has been employed in some cases.

Privatization is appropriate in some instances, though it can take many forms and full private ownership, as in the United Kingdom, is an extreme – and rare – variant. The French model of concessions and lease contracts has influenced a number of developing countries, e.g., Côte d'Ivoire, Guinea, Malaysia, Morocco and Thailand. Regulated private companies also operate in Santiago de Chile and Guatemala City.

Participation: NGOs and WUAs

An increasing number of private sector groups, including WUAs and other NGOs, are taking over some public-sector irrigation responsibilities. The inclusion of water users in irrigation planning, management and ownership is proving to be an effective method for increasing irrigation system efficiency in many cases. Studies throughout the world demonstrate that user participation in irrigation services improves access to information, reduces monitoring costs, establishes a sense of ownership among farmers and increases transparency as well as accountability in decision making. Already, governments are turning many aspects of public irrigation systems over to WUAs, and well-documented examples can be seen in Argentina, Colombia, Indonesia, Mexico, Nepal, the Philippines, Sri Lanka and Tunisia.

NGOs can undertake a wide range of water-related functions, from developing projects for rural water supplies and minor irrigation, to fostering WUAs for water management purposes. Many NGOs stem from local initiatives and operate as independently funded and self-managed groups. These organizations bring fresh views, new ideas and participatory working methods to other areas of development policy and practice. Much of their success is attributed to their local knowledge, as well as to their interest in and experience of regional conditions. They have been particularity active in promoting the interests of poor and disadvantaged groups through articulate and forceful advocacy and service provision.

The local base of NGOs may allow them to reach vulnerable or remote groups which are exceptionally difficult to reach with conventionally conceived and managed public schemes. With their close local contacts and skills in group mobilization and cohesion, NGOs can provide the institutional leadership required to bring about socially acceptable solutions, and in some cases (e.g., the Philippines) serve as community organizations.

ECONOMIC MEASURES

Macro-micro links

Improving water resource management requires recognizing how the overall water sector is linked to the national economy. Equally important is understanding how alternative economic policy instruments influence water use across different economic sectors as well as between local, regional and national levels and among households, farms and firms. For too long, many water managers have failed to recognize the connection between macro-economic policies and their impact on, for example, technical areas such as irrigation.

Macro-economic policies and sectorial policies that are not aimed specifically at the water sector can have a strategic impact on resource allocation and aggregate demand in the economy. A country's overall development strategy and use of macro-economic policies – including fiscal, monetary and trade policies – directly and indirectly affect demand and investment in water-related activities. The most obvious example is government expenditures (fiscal policy) on irrigation, flood control or dams.

National development strategies can directly influence water allocation and use in other ways. In the case of a food self-sufficiency strategy, the government may subsidize water-intensive inputs to encourage farmers to produce more rice. By providing financial incentives for rice producers, the government is influencing the demand for water and private irrigation investment through price policies.

Creating incentives

The best-intentioned and -designed reforms in the water sector may be frustrated if key economic signals work against them. For example, the benefits of rational pricing of irrigation water may be negated by artificially high farm-support prices. Penalizing wasteful industrial water use by pricing and effluent charges will be nullified by high protection on the output of heavy industry or by 'soft' budget constraints enabling parastatals to pass on increased water charges and fines to their sponsoring ministries. Hence, in those countries where water is becoming the scarce factor of production, action in the water sector should be consistent with other key economic signals.

The permissive effects of enabling conditions may be sharpened by the creation of incentives for the more rational use of water. These may be positive or negative, market or non-market. They will be categorized below as: tariffs; pollution charges; water markets; and non-market inducements.

TECHNOLOGY

Informing policy-makers of the choices of appropriate technology to meet policy goals and making them aware of the significance of their interactions and impacts is an important but little-explored area of strategy formulation. It highlights problems of common understanding and dialogue between specialist technicians, planners, politicians and the general public, and indicates that improved and simple communication of complex ideas is a fundamental component of human resources development and capacity building. Conversely, improved knowledge of policy frameworks and water resources management strategies allows technologists to assess the context and value of their research and adapt it accordingly.

Although one of the reasons for this publication is that water resources *development* has too frequently been technology-driven, it is clear that technology, information and management capacity go hand in hand. Water resources strategies should not overlook technological solutions where they are appropriate or even fundamental to improved and more rational management. As management decisions become increasingly complex and information intensive, the demand for appropriate supporting technology actually increases and cannot be omitted from the equation. Box 7 provides an example of a recent initiative in China, which has a strong technology focus, although it was framed within the context of a cohesive national water management strategy.

PROJECTS AND SPENDING PROGRAMMES

The process of water strategy formulation is likely to culminate in drawing up, revising, or implementing projects and programmes entailing public expenditure. It is important that the choice of projects, and the way they are designed and carried out, is consistent with the overall strategy. Four processes are particularly relevant in this context: cost-benefit analysis, cost-effectiveness analysis (both discussed in Chapter 8), EIA, and financial management.

Projects and policies

The impact of the kind of reforms suggested in earlier chapters would be to produce an 'enabling environment' in which better decisions about water were made. Some of these decisions would be made by private individuals, farmers and companies – e.g., in response to regulations, pricing, or the development of water markets. No further action would be required of the state.

BOX 7 THE CHINESE APPROACH

China has launched a ten-year programme that calls for the expansion of the irrigated area from 48 to 53 million ha, and for drainage of 3 million ha of land with surface waterlogging and of 2 million ha of saline/alkaline land, all of which will not be possible without technology research and adaption of advanced technologies from other countries. For the research themes proposed under the International Programme for Technical Research in Irrigation and Drainage (IPTRID) in China, the focus is on four areas:

i. Water- and energy-saving technology.
ii. Operation and maintenance of canal systems.
iii. Waterlogging and salinity control.
iv. Training, networking, and international support.

Of 22 research proposals identified for a possible programme, seven were selected as priorities:

- Optimization in the use of water and energy in farm irrigation.
- Water management in systems where surface water and groundwater are limited in quantity.
- Prevention of seepage and frost-heave.
- Technology for structure rehabilitation.
- Support for networking in irrigation and drainage research.
- Institutional support for leading research institutes.
- Guidelines for salinity control, drainage design and design of field drainage to control waterlogging.

Policy reforms may substitute for projects. In the event of an emerging water shortage in a sector or region, the government has the broad choice of introducing demand-management and conservation policies, or investing in new supply schemes. In this sense, projects may represent the 'easier' option, at least in so far as they are more popular with the public and avoid difficult changes in consumer behaviour. However, a new strategy will typically involve both policy reforms and projects and spending programmes, which require more detailed economic assessment, as outlined at the end of Chapter 8.

Environmental assessment

The water sector is simultaneously a major perpetrator and victim of environmental change. The provision of water often entails drastic interference with natural hydrological systems (e.g., dams, reservoirs, river diversions, aquifer depletion). But, equally, water is polluted by the waste from other sectors, and irrigation and urban water supplies are vulnerable to upstream activities, and the deterioration of upper catchment areas and watersheds. Water is inextricable from the environment and the pre-condition of any important decision in this sector is an understanding, firstly, of its own environmental effects, and, secondly, how environmental change triggered by other forces will affect this sector. Determining environmental values and making the economic case for environmental action and protection is an emerging discipline, and the reader is referred to recent literature for a general introduction (e.g., Winpenny, 1991).

Chapter 5
Institutional and human resources issues

The chapter considers the wide scope of institutions with importance in relation to the formulation of water resources management strategies. It focuses on assessment and institutional analysis, and covers legislation, including regulation, administration and enforcement, and public and private organizations at different levels.

Finally the significance of the personnel staffing the organizations is underlined, with the presentation of a brief overview in summary form of the most important aspects of human resources development.

Experience shows that institutional weaknesses and malfunctions are a major cause of unsustainable and ineffective water services. To remedy these shortcomings requires attention to building institutional capacity at all levels, especially as there is increasing pressure to improve service delivery by making agencies more demand responsive. Also, the need for better and more rational water resources management and to facilitate allocation amongst all users suggests an expansion of *national integrated planning*. A critical institutional challenge is to become more adept at developing policies, rules, organizations and management skills to address these needs simultaneously without constraining specific major aims.

Capacity building in developing a water resources strategy involves:

- creating an enabling environment with appropriate policy and legal frameworks;
- institutional development, including community participation; and
- human resources development (HRD), and strengthening of managerial systems.

UNDP's Capacity Building Programme for Sustainable Water Sector Development stresses 'vertical' capacity building within an individual water sector and 'horizontally' between sectors. It recognizes that capacity building is a long-term and continuing process involving all stakeholders.

In this framework, the term 'institutions' refers to both the set of rules governing water use and the specific organizational arrangements involved in the formulation and implementation of water resources laws, policies, strategies and programmes. Together, these rules form the enabling environment for water resources management. Changes in the rules, organizational arrangements and means of HRD may be required to effectively translate water resources management policies into an action programme. Such changes should provide incentives for improved performance in terms of water resources planning, allocation and operations management. Sound institutions together with high quality human resources are the best assurance of achieving water sector objectives.

Two objects are served by analysing institutions and human resources: first, it assesses existing rules and organizational arrangements and matches them to the demands of programme implementation, and, second, it identifies means of strengthening capacity to undertake strategy formulation on a continuing basis.

The strategy formulation process is an opportunity to evaluate whether institutions and HRD programmes in a country effectively serve the national water resources management goals. Evaluation of the set of rules is an opportunity to consider the social norms governing water supply and use, as well as whether explicit policies, laws and regulations are sufficient. A review of organizational arrangements can reveal whether existing or recommended rules can be enforced; it is also a chance to consider ways of involving community organizations, WUAs or professional associations in the planning and management of water resources. Finally, HRD considerations involve a look at supply and demand for key personnel, as well as education, training, employment, career structures and incentives.

Water resources management strategy is country-specific. Analysis of institutional and human resources should pay special attention to a country's culture in terms of its legal framework, the mix of public and private sectors, educational and manpower development policies and traditional modes of organization. In some cases, religious beliefs direct a certain code of conduct with regard to society's management of natural resources. Therefore, in the analysis of institutions, particular care should be paid to social and cultural practices governing the use of the resource. Institutional analysis should lead to:

- an inventory of information,
- identification and analysis of key issues,
- development of options for a legal and regulatory framework, and
- organizational arrangements and human resources requirements to achieve desired policy goals.

ASSESSMENT AND INSTITUTIONAL ANALYSIS

The starting point for institutional analysis is a country's water resource policies. Certain broad directions of reform are visible in the developing world. For example:

- The roles of the government and the private sector are often being redefined. In the past, governments generally provided many water planning and management services. Increasingly, countries are experimenting with a variety of organizational arrangements where the government retains overall planning and regulatory functions and manages major water infrastructure, whilst delivery of services is being decentralized to the lowest level possible. The Philippines has experimented with a semi-autonomous national agency for irrigation management. More recently, Indonesia has initiated a process of transferring O&M functions in small irrigation schemes to users. Mexico has launched an ambitious programme of transferring the management of entire irrigation districts to water users. Chile has implemented policy reforms to allow tradeable water rights. Côte d'Ivoire, Guinea, Argentina and a number of eastern European countries have experience with privatizing metropolitan water utilities.
- The need to incorporate environmental considerations in the planning and management of water resources, both at sectorial and project levels, is being more widely recognized.

The following legal aspects should be addressed during strategy formulation:

- Laws and customs governing water rights, principles of water allocation between various uses, water pricing and private sector participation.
- Regulations concerned with surface water, aquifer and groundwater management (especially pollution control and reuse of these resources).

Regarding institutional aspects:

- Organizational arrangements have to be addressed, such as mechanisms for coordination at the national, provincial, and local (basin) levels. These should specify responsibility, authority and accountability for planning, regulation, and operations. Such arrangements should also include a system of HRD incorporating education, training and incentives for improved service.

WATER RIGHTS AND LEGISLATION

The necessity for legal reform was introduced in Chapter 4, although in practice the complexity and long history of existing legal frameworks and precedent make this a daunting task. Simple prescriptions of legal reform are unlikely to account for the cultural, political and economic background to the legislation in place. For instance, the present Water Law in Spain has evolved over the last 100 years, and the consolidated Water Act (1989) in Australia combined and rationalized 15 separate pieces of legislation.

A recent FAO review (discussed in FAO, 1995b) of legal issues and legislative requirements of water resource policy review and reform concludes:

- as policy and strategy options begin to crystallize, the legal implications and attendant legislative options emerge and can be evaluated to the point of enacting legislation in support of the transition from policy option to policy action;
- in practice, policy crystallizes and legislative drafting instructions are issued before any analysis of legal issues has been undertaken. It is also often true that legal problems only emerge after attempts have been made to put policy into practice, for instance the vagueness of Mexico's new water legislation with respect to transferable water rights and their separation from land title; and
- experience points to a series of actions in investigating legal issues and legislative requirements of water policy review and development of strategy, namely:
  - collection of all legislation in force on, or related to, water resources management;
  - analysis of such legislation for consistency, with a view to detecting issues pertaining to established rights and governmental powers, and in general to assess the legislative drafting required to implement a new policy or strategy; and
  - drafting of the required legislation.

Examples of problems of consistency with existing legislation include the case where the proposed regulatory policy of water abstraction and use may require a modification of the rights to use water held by individual or corporate members of the public. This would entail decisions about the extent to which such rights would be subject to change, what guarantees should be offered, and possible compensation.

Policies may require a modification of the powers or scope of authority of the governmental or para-governmental bodies responsible for water resources management or develop-

ment, or for related functions (i.e., public health preservation, environmental protection, management of lands and forests, or conservation of wildlife). The introduction of a water charging policy may require modification to legislation currently giving water a non-economic status, or a modification of the privileges enjoyed by given user groups, such as farmers.

The policy review may imply new legislation – as opposed to amending legislation already in existence. Implications for substantive legislative drafting should be recognized, especially if privatization or the introduction of corporate status to water departments is foreseen. Mechanisms for assuring the public accountability or control of private and autonomous bodies can be legally complex. If it is proposed to allow the transferability of water through marketing water rights, the key legal questions are whether water should be transferable separately from the land where it is used, and whether transfers would be free or controlled by the Government.

Water rights have generally originated in historical use and have been sustained over time by custom, sometimes confirmed by specific legislation or constitutional decree. In many cases, the nature of water rights is vague. Realistic assessment of customary rights, and granting of appropriate legal recognition, is an complex and intrigue-prone undertaking that is important on equity grounds, but if handled badly is likely to have strong political consequences.

In some cases, government regulations may substitute for law, as in the case of operating rules of a reservoir that may determine water allocation for different uses. The strategy should include a coherent legal programme and should consider the training and enforcement requirements consistent with existing and proposed legislation. One key question is whether formal establishment of rights is warranted. It should be remembered that once rights are conferred it is not easy to withdraw them. Any new system of conferring rights should also pay attention to equitable allocation among users, including their access to relevant information.

The system of rights may include the right to trade water. Irrespective of whether formal rights exist, informal markets for water can be observed in various countries and specific written or verbal contracts may govern water trading, as is often the case with trading between irrigation organizations or between such organizations and other users. Lack of extensive irrigation infrastructure restricts conveyance capacity and may restrict the tradability of water. In the case of drinking water supply in the cities, there is some evidence of the population's willingness to pay for water supplied by private vendor, typically entrepreneurs with access to groundwater. Phase I of the water strategy formulation process (Figure 2) provides an opportunity to record the existence and spread of such practices and to determine whether they help meet a country's goals and water-related policies, and whether strategies should promote or discourage such activities.

Laws will usually specify the entity responsible for managing water resources and assets in the sector. Usually, a range of ownership and management entities will be found in a country, including the central and provincial governments. Other managers of water resources and infrastructure include semi-autonomous public agencies (such as river basin commissions), private companies, cooperatives and user organizations. The nature and type of governance and administration of these legal entities, including their accounting and audit procedures, should be of central interest to institutional assessment. For instance, in some cases, existing laws of incorporation may hinder the transfer of ownership or management from government to other agencies.

Conflicts and conflict resolution are inherent in any sharing of resources. Conflicts may be resolved by interpersonal means, local community organizations, government agents or the courts. In the case of international or interprovincial waters, allocation rights and conflict resolution procedures could be part of agreements and treaties. Identifying mechanisms that will not only resolve conflicts but also prevent them could be important. In this regard, existing community practices for dispute resolution would be an fruitful area of inquiry. Experience with water rights in some developed countries suggests that it is important to forestall an expensive litigious process of dispute resolution through the courts, where cases may be tied up for long periods of time.

REGULATIONS, ADMINISTRATION AND ENFORCEMENT

The enforcement of water legislation and policies depends on the relevance of the regulations and on the administrative machinery required to ensure compliance. For instance, in many countries, the regulation of groundwater abstraction is weak and siting restrictions for pumps are either absent or poorly enforced. Aquifer monitoring to alert decision-makers to draw-down levels is often absent and special attention is needed during the assessment phase to collect and analyze information about groundwater regulation and its enforcement.

Water regulations might cover land use rights related to water management, watershed development, environmental quality and pollution control standards, dam safety standards, service standards for water supply, and financial and management standards. A principle to remember in this context is that users should not also be the regulators – in the UK, the recently privatized water companies are controlled by separate price and environmental regulators, whereas previously water authorities set and implemented standards for the same locality that they managed.

A study of the effectiveness of the present enforcement capabilities is a necessary part of the assessment and careful consideration should be accorded to the costs and benefits of enhancing enforcement: alternatives might include increased staffing or using instruments such as tradeable pollution licences.

ORGANIZATIONAL ARRANGEMENTS

There are five broad areas of organizational responsibility for water resources management: (a) planning and coordination, (b) design and construction, (c) regulation, (d) social and environmental action, and (e) operations management. Governments can use a range of instruments to discharge responsibilities in these areas and it is impossible to prescribe the best formula for all contexts. The ultimate organizational form will have to suit the country's own political, cultural and administrative norms and practices. However, three major considerations should be kept in mind:

- Do present organizational forms favour separation of operations from planning and regulation, or would implementors perform better if they participated in the planning of their future tasks?
- What are the priority areas for government involvement for effective water management?
- Are financing arrangements for capital and operation of water services appropriate?

Planning at different levels is needed for effective water resources management. Planning involves (a) collecting data on water quantity and quality, (b) properly analysing and disseminating the data, (c) establishing water supply and demand balances, (d) identifying

areas for long-term water development and management at the national, provincial or basin level, and (e) determining drought and flood protection needs. In institutional analysis, the focus should be on assessing the effectiveness of planning agencies and the mechanisms for ensuring technical inputs, economic analysis and stakeholder participation. Institutional assessment would also focus on evaluating the capacity of existing institutions to undertake water planning exercises on a continuous basis.

Design and construction has been a major activity of many water-sector agencies. This is a specialized technical function that has long been a source of power and pride for these agencies. Increasingly, however, emphasis is being placed on management of resources rather than on new construction. The transition from a civil engineering to a water management agency is difficult and is fraught with political and organizational pitfalls. The water resources assessment should carefully evaluate the extent of coordination of all water agencies and their respective forward plans.

Coordination is a key aspect of planning and management. Several economic sectors and many water users are involved in water allocation and their actions need to be coordinated within an overall water resources management framework. The question is how to bring the sectors together. Some countries have established inter-ministerial water councils for planning purposes, with leadership from planning or finance ministries to avoid the bias of a particular user sector (such as irrigation, which is the dominant sector in many cases). These councils also include representatives of the community at large to ensure participation of NGOs and trade and professional associations. Similar mechanisms can also be established at the level of river or drainage basins.

Coordinated management action is important with respect to surface water and groundwater, examples being in release schedules from dams, conjunctive use of surface water and groundwater, and urban wastewater disposal.

The question of restructuring incentives in the irrigation and municipal water supply and other water-related sectors is a crucial institutional question in attempting to improve O&M, and to link quality of service to payment of user charges. A number of alternatives to government provision of services are available. The 'utility' model is one which focuses on a single purpose of delivering a measurable service to users and has been adopted in developed and in some developing countries. Various types of private-sector participation are possible. Service contracts empower a contractor to provide a specific service. Management contracts ensure that the contractor assumes responsibility for managing, operating and maintaining all or part of a water system. Lease contracts earn the government rent for use of facilities with the contractor assuming full responsibility for operations. Concessions add a level of responsibility to the contractor in that he invests in additional capital facilities and is responsible for associated debt service. 'Build, operate and transfer' programmes require a public or private agency that builds and operates the facilities after commissioning and then hands over the management to a designated agency. A variant on this is the 'build, own, operate and transfer' programme, where temporary ownership of the facility by the builder may have favourable financial consequences. User organizations that contract with a government agency or manage a certain part of the water system are another option.

Institutional analysis during the water resources assessment phase of strategy formulation affords an opportunity to examine the participation and roles of NGOs in water resources planning and implementation. Representatives of these organizations should be included among the stakeholders consulted during the strategy formulation process, because

they may ultimately be involved in strategy and project implementation. Two types of NGOs with a useful role to play are community organizations and professional associations.

Community organizations

There is an established history of community involvement in the design, management and maintenance of *projects*, particularly in irrigation and in water supply and sanitation. Community involvement can be in the form of membership (user) organizations and non-membership assistance or activist groups. Community involvement in *sectorial and strategic planning* and management is much rarer, but it is increasingly thought to be important, although gender and equity issues are complex in this context. A strategy review should consult community organizations and incorporate them into the planning and management framework at appropriate levels.

Professional associations

National and international non-governmental professional associations have long played an important role in enhancing the capacity of industrialized countries in the water sector. They have contributed in many ways.

- They provide a forum for reporting and updating technical and managerial knowledge in the sector and making it available to professionals and the broader public.
- They work with national decision-makers in defining policy and setting standards.
- They can provide a common link between public agencies, consultants, manufacturers, industry and the public.
- They promote national and international exchange and cooperation in training, research, technology and in sector development.

While well established in the industrialized countries, professional associations are weak in most developing countries. Important contributions to national capacity building in the water sector can come from initiatives by international professional associations. Relevant examples include the International Water Resources Association (IWRA), which deals mostly with irrigation and drainage issues; the International Water Supply Association, which operates on technical issues in the water supply subsector; and the International Association for Water Quality, which covers the sanitation subsector. The International Commission on Irrigation and Drainage (ICID) assists national associations involved in irrigation.

HUMAN RESOURCES DEVELOPMENT

Frequently, the organizational arrangements in the water sector are less important than the people who staff it, and sound institutions with high quality human resources should be the target to provide the best assurance of achieving policy objectives. HRD covers all actions necessary to develop a qualified and motivated staff in organizations at all levels, and includes training and education; staffing plans; career and salary development; and the creation of a stimulating personnel environment within organizations.

Although both training and education are essential instruments in long-term capacity building, they have different purposes and time scales. Training is aimed at specific problems, implies shorter contact times and attempts to offer directly applicable skills. Education has a broader remit, covering factual knowledge, insight, applicable methodologies and professional attitude. Twenty years of UN-related experience has led to calls for a fresh look at the educational aspects of HRD. The continuing rise in population and urban

concentration call for an increase in numbers of professionals as well as enhancement of their technical and managerial skills, in addition to better conceptual and strategic capabilities. An unequalled demand for provision of new urban infrastructure is forecast over the coming two decades, which will entail rapidly increasing technical and multi-disciplinary complexity. Sector professionals will need to be better prepared for these challenges and this implies that:

- vocational and tertiary level (particularly post-graduate) facilities need to be expanded and improved in quality;
- curricula need to be adapted to be more responsive to key sector problems, and teaching methodologies need to be more effective; and
- there needs to be great emphasis on developing inter-disciplinary skills and attitudes so that graduates are comfortable and equipped to work in increasingly integrated environments.

Estimates of both available and required skills should be made during the water resources assessment. Training needs should be geared to long- and short-term institutional objectives. General skill areas that could be evaluated include technical (e.g., fisheries specialists, hydrologists and toxicologists), managerial and cross-disciplinary skills (e.g., economists and ecologists).

Many water-related educational and research programmes can be commissioned from local universities and other educational institutions. A common practice is to have a utility provide the university with funds for senior students to undertake tasks important to the utility, so that all parties benefit. The worth of training may be eroded if individuals are placed in an environment that does not utilize or support their education and therefore staffing patterns must be well understood and opportunities for promotion increased and made commensurate with merit.

There are also a number of international training initiatives, such as the International Training Network (ITN), which provides resources that can assist countries in their own training efforts. The ITN is a product of the UNDP-World Bank Water and Sanitation Programme, and currently has nine members in Asia, Africa, and Latin America.

Chapter 6
Stakeholder participation

Here stakeholder participation is brought forward as a two-way communication process and an integral part of the overall formulation process to identify and as far as possible to reconcile the interests at stake, to produce a well-informed base for water management strategies.

Acknowledging that there could be possible constraints to the participatory process, it continues with identifying stakeholders and the different levels of participation. Finally the chapter provides suggestions on appropriate means to involve and consult stakeholders during the different phases of the water management strategy formulation process.

DEFINITION AND BENEFITS OF STAKEHOLDER PARTICIPATION

Many water resources policy-makers and project managers are familiar with the concepts and techniques of community involvement in water resources projects, at both the design and implementation stages. Stakeholder participation in formulating a strategy for water resources management has many similar aspects. The variety of stakeholders in national water resources policy is of course broader, as is the variety of issues. Stakeholder participation is the process of involving those who are affected by and thus have an interest in water resources, and hence in the formulation of water strategy. It is a two-way communication process that explicitly seeks to identify and to clarify the interests at stake, with the ultimate aim of producing a well-informed water management strategy that has a good chance of being implemented. Stakeholder involvement should be an integral part of the process of developing a strategy, mainly because it can:

- ensure that alternatives serving a broad range of interests are considered;
- help to gather data or information, identify gaps in data or information, and identify those who might provide data or information in the future;
- provide transparency and accountability regarding both decisions taken and the process by which those decisions were arrived at;
- accustom stakeholders to the fact that some difficult choices may have to be made in order to manage water resources effectively; and
- build a broad base of commitment to options by creating an environment that rewards the realistic discussion of benefits, risks and costs of options and that provides a meaningful basis for informed consent to recommendations.

At least two activities are involved in stakeholder participation: the identification of stakeholders, and securing stakeholder contributions to a water resources strategy. Building commitment to and ownership of water strategies will depend on satisfying interested parties in several ways: substantive, procedural and psychological.

In certain situations there may be barriers to effective stakeholder participation in the form of cost, access and prevailing cultural norms. This chapter presents the principles and methods that are desirable, but those developing water resources strategies will have to bear

the responsibility of deciding the limits of practicable participation within constraints of cost, time and a realistic assessment of the likely value of the outcomes. Some governments have committed considerable funding to community-developed plans for water resources management, such as the salinity action plans and catchment management boards in Australia. Many other countries, or their agencies, do not have such commitments or traditions and may be suspicious of the motives and intentions of community participation, but world-wide experience increasingly illustrates the benefits that it can offer.

WHO ARE STAKEHOLDERS?

Stakeholders can be individuals, organizations or groups. Stakeholders include:

- public-sector agencies involved in water resources (for example, departments of agriculture, of industry, of transportation, or of recreation),
- various *levels* of public-sector agencies in the water sector (state, regional or local),
- private-sector organizations and companies with water interests,
- environmental and professional NGOs, and
- representatives of those people likely to be affected, specifically including people who may have little knowledge of the effects of strategy and who may lack the means to participate.

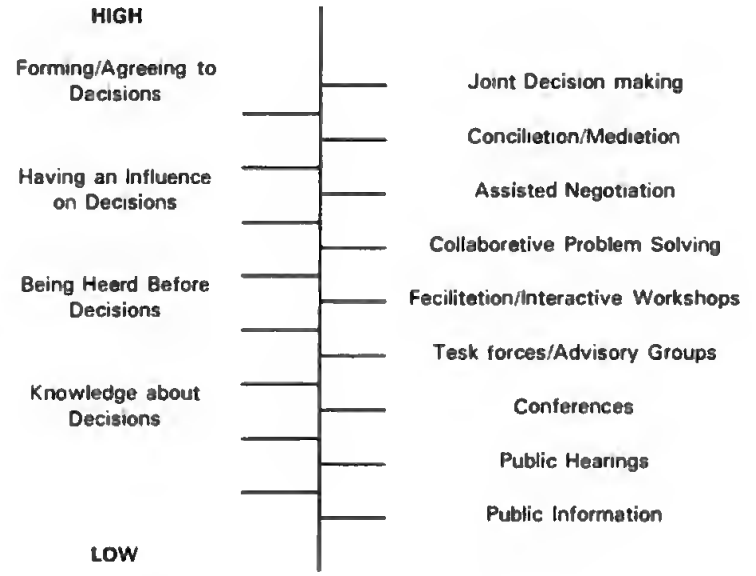
A variety of methods can be used to identify stakeholders. Three of the simplest approaches are self-identification, third-party identification, and identification by the strategy team. Self-identification simply means that individuals or groups step forward and indicate an interest in participating. Third-party identification uses knowledgeable parties, such as existing advisory committees, informal or formal community leaders, and representatives of known interests, to suggest people or organizations that should be included. Identification by the strategy team relies on the team systematically identifying and approaching stakeholders. Social impact assessment, EIA, financial analysis and gender analysis can all help to identify stakeholders. The team should identify those parties essential to implementing projects, those who are benefitting or will benefit from water projects, and those who are bearing project costs and impacts. Most importantly, people who would be affected by water strategy, but do not yet know that they will be affected, should be identified. Stakeholder participation is a means of giving them a voice.

LEVELS AND TECHNIQUES OF PARTICIPATION

Different stakeholders will seek different levels of involvement and various categories can be defined. *Listeners* are those who need to be informed but do not feel a need to be actively involved in policies and projects. *Observers*, while not actively involved, are watching the policy assessment process and may become active if access to information is cut off or if they are surprised by events in the assessment. *Reviewers* actively watch the assessment process and will review ideas and materials. *Advisers* contribute their own time and energy and are willing to be actively involved. Their high level of interest and concern must be matched by equally high commitment and efforts by the water strategy team. *Originators* are so involved that they help create options. This is a high level of involvement and may be difficult to sustain. *Decision-makers* are stakeholders who seek a level of involvement where they have a vote in or some control over the decisions made.

Figure 4 illustrates various levels of involvement with examples of participation techniques appropriate to each level. The lower levels of participation are characterized by

FIGURE 4
Levels of stakeholder participation and examples of participation techniques



traditional public information programmes and public hearings. These are typically techniques that emphasize one-way communication. Moving up, techniques such as task forces, workshops that may involve a neutral person to keep them focused (a facilitator) and collaborative problem solving are emphasized. Typically these are techniques that emphasize two-way communication and often use the neutral assistance of facilitators to help shape the process, but not the substance, of dialogue. The high end of the scale includes structured techniques designed to produce consensus, agreement, or resolution, such as conciliation, mediation, and arbitration.

STAKEHOLDER PARTICIPATION DURING STRATEGY FORMULATION

The strategy team might consider using citizen and technical advisory committees. The team should be clear about the role of such committees, as it could easily rely too much on them and not attempt to reach more stakeholders directly. One interesting form of citizen committee is a planning group which, like advisory committees, may be expensive. In a planning group, a cross-section of stakeholders is chosen randomly to work on a problem or policy issue for a short period. They are often paid and should have full access to key information and to decision makers. Their activities are highly visible and may yield a report to be considered by decision makers.

Phase 1

Phase 1 (see Chapter 3) of formulating a water sector strategy involves preparing an inventory of information and experience while identifying and analysing the major issues in the water sector.

At minimum, the water sector strategy team should decide what information is needed from and what information should be given to various stakeholders. Also, public awareness should be generated at the start of the process. Stakeholder involvement can be particularly valuable in providing and reviewing available data and determining priorities for data-gathering. Stakeholders are the best judges of their own interests and are thus the best sources of data about them. Since they will ultimately have some say in the viability of water policy options and since that discussion will to some degree revolve around data issues, early stakeholder agreement about the information base will be critical. Even if stakeholders produce data similar to that from other sources, their involvement will produce some affiliation with the data base. Because an ideal data base can be fashioned only rarely, stakeholder participation will help to decide which gaps in the data base are the most important to fill. This approach is likely to produce conflicting data. This often highlights the subjectivity of some types of data and can uncover important and contentious issues early in the consultation process.

In the identification and analysis of issues, it is important to go beyond a list of needs and to understand the interests behind those needs. While representatives of stakeholders can provide a list of issues, needs and priorities, the assessment should go further and try to reach stakeholders directly. The most effective method at each stage is a focused workshop that is attended by the water sector assessment team. Surveys and questionnaires are most effective when used together with more direct participatory techniques.

Between Phases 1 and 2

Between Phase 1 and Phase 2, the strategy team and decision-makers must take stock of results and decide whether they should proceed with the water sector assessment. The team should seek clear direction, if not agreement, from stakeholders about the path of the assessment and publicize their findings. The water strategy team could also hold a series of evaluation workshops to help determine if the strategy process should proceed and whether more information is needed, as well as giving some early indications of what type of options and scenarios should be used.

Phase 2

Phase 2 begins by developing options and is where stakeholders can contribute creatively. Stakeholders and team members should review what they have learned and reduce the number of strategic options under consideration. This can be done using small workshops and selected stakeholder representatives.

Once options have been developed, they should be evaluated using both process and analytical techniques. Delphi techniques – where stakeholders are asked to independently create and evaluate options which are given back to them for re-evaluation – can be used to narrow the range of opinions about options. Simulations and other decision-support tools provide new possibilities for meaningful stakeholder participation. Assisted negotiation techniques (mediation, facilitation and collaborative problem solving) can also be used here.

Public meetings or hearings are appropriate at the conclusion of Phase 2. If there has been effective participation, few surprises should emerge at this stage and perhaps there will be agreement on proposed actions. At minimum, these meetings would affirm areas of, and reasons for, agreement and disagreement. Stakeholder participation is as much an art as a science, and considerable judgement is required.

Chapter 7
Information systems

The focus of this chapter is the importance of a water resources information system in estimating the quantity and quality of water available, as well as the current and prospective water use and demand patterns. The goal of this section is to assist in preparing an information system assessment in order both to develop a water resources management strategy and to design or improve a system.

The discussion covers not only the collection and analysis of data but also which data are available and how they are disseminated, i.e., how the data are collected, analysed and shared. Information is a vital element in many – if not most – aspects of integrated water resources management, but particularly in the institutional, international and economic areas.

JUSTIFICATION AND RATIONALE

The need to revitalize and modernize an information system normally arises at a stage in the development of water resources when some of the following characteristics manifest themselves:

- there is an increasing scarcity of water, resulting in unacceptable competition and conflict,
- riparian rights are becoming a major issue,
- costs of developing new water supplies are rising,
- the economic values of stream flows are increasing,
- environmental and health concerns are increasing, or
- floods and droughts are increasingly prevalent.

When the efficient allocation of water depends on the analysis of more information than the government has available, there is a need to evaluate and improve the water resources information systems. Uninformed or inadequate decision making will eventually paralyse both the public and private sectors as different economic sectors or different countries compete fiercely for water. In addition to helping form a strategy to manage water, information technology – with its 'decision-aiding systems' – can assist the efficient management and allocation of water in rapidly changing supply and demand conditions.

Decision-makers will be better able to form sustainable water resources management strategies if they are provided with credible historical information on water resources. Implementing strategies will depend on timely information for day-to-day management decisions.

ELEMENTS OF A WATER RESOURCES MANAGEMENT INFORMATION SYSTEM

The ultimate requirements and form of the information system need to be examined. The six main components of an information system are:

- data collection,
- data transmission,
- data storage, analysis and transformation into 'user-friendly' information,
- information transmission,
- information dissemination, and
- an interactive system to aid decision making.

Data types

In gathering data on *resources*, there is likely to be a disparity between information on water supply, on the one hand, and water quality, on the other. While problems of water supply are widely recognized as an issue in water resource planning and management, the problems of water quality are insufficiently acknowledged. River quality is, for example, very complex and great simplifications are needed for practical planning purposes. As the worst quality at any point is far more significant than the best or average quality, it is important to have data on maximum or extreme values.

The inventory of current *diversion and in-stream uses* should cover aspects of location, quantity, quality and state of information in each case. The most important categories are likely to include:

- urban and industrial water supply,
- conveyance and disposal of wastewater,
- agriculture,
- flood protection,
- aquaculture and fisheries,
- hydropower,
- navigation,
- tourism,
- recreation and amenity,
- protection of the human and natural environments,
- defence,
- and so forth.

Obtaining information

There are a number of aspects to consider.

- *Right of access to information* It may be readily available, require persuasion or require compulsion. Holders of information on water may regard it as sensitive and want to impose confidentiality in its use.
- *Information requirements* Gathering and processing information can be a huge task, so requirements should be kept to the minimum required for the strategy, and gathered cost-effectively. Data should be disseminated to those who really need them, to avoid duplication and wasted effort.
- *Information quality* Good quality information is essential. Data are often inaccurate and potentially misleading, unless an effective information system has been in place for some years. Forecasts based on misleading historic data will be false. The motives of those giving information should always be considered. Water users who expect

to benefit from improved provision, but not to pay for it, will have an incentive to exaggerate their requirements.

- *Abbreviation and simplification* Specialists should reduce and simplify their information and, especially, tune it to the specific needs of policy-makers, to maximize its effective use. Generalists, for their part, must give the specialists clear guidance on what information they need.

In addition to the points raised above, the team should consider details of managing the information collected:

- *Information technology* What is available for water resources management? What are its present and future roles? What are its advantages and disadvantages and present patterns of ownership?
- *Information demand* Aside from water resources managers, who else needs information (for example, policy-makers, researchers, educators, private enterprise, water resources stakeholders)? What kind of information is most urgent?
- *Costs of information transfer* Who pays for the information? What are typical public good aspects of information (such as water quality) and what are private aspects (such as water rights)?

The questions asked above can be used to create terms of reference for the improvement of an information system. Those undertaking an information system assessment should interview representatives of the relevant government ministries and other key stakeholders.

Hydrometeorological data are collected by a variety of national agencies and can be collated. It is useful to draw up tables or checklists that codify the availability and adequacy of data on both resource availability and resource use, sector by sector. The precise form of the checklists will vary considerably according to context and will not be considered here. In addition to traditional uses (hydropower, irrigation, navigation, industry, potable water, etc.), hydrological data are becoming vital in areas such as preserving ecosystems, maintaining the aquatic environment, preventing both deforestation and soil erosion, maintaining or improving public health, controlling pollution, maintaining or improving recreation and tourism, and predicting the climate.

Because many decision-makers (and the general public) are normally unaware of the economic value of water and the vital role it plays in the development process, it is not likely that water resource data are adequately assessed and used in decision making at any level of the community. Since an information system is about the management of data in all their forms, those responsible for information system assessment might recommend that the sources of both water supply and demand data be improved. This means working with the institutions responsible for generating these data, usually the national hydrological and meteorologic services, the water users, companies and associations.

IMPROVING WATER RESOURCES INFORMATION SYSTEMS

In many practical situations, the quality, quantity and form of existing information may not match the rigours of improved planning and strategy formulation. Analysis should assess:

- the ability of the present information management system to meet both the short- and long-term development objectives, including those in the legal, technical, economic, institutional and policy frameworks This should include analysis of strengths and weaknesses of the present information management system;

- the strengths and weaknesses of greater use of information technology within the framework mentioned above;
- possible changes to the framework that would enhance overall performance of the information system, with and without greater use of technology; and
- capacity building required to obtain improved performance from the information system, with and without a greater application of information technology.

As appropriate for local conditions, the report should assess the relevance of information technology for the country or for specific hydrological basins. This should include a review of the possibilities of cost reduction in information management and the appropriateness of hardware and software to be employed in upgrading data collection and management.

Given below are recommendations for improving a water resources information system. They are common to many assessments.

Network rehabilitation

This includes repairing and upgrading hydrometeorological networks for measuring many parameters – including water quantity and quality, rainfall, evaporation, humidity, air temperature, and wind – through the installation of basic equipment. Network rehabilitation often involves improving the operation and maintenance of equipment and establishing telemetric systems if necessary. Studies often propose that the authorities consolidate and rationalize the existing hydrometeorological network rather than expand it.

Institutional and human resources development

Carefully tailored training programmes should emphasize in-service training, using the agency's own facilities as far as possible. It may be appropriate to provide this kind of training by expanding the activities of established training centres within existing academic or training institutions. In many countries, two or more agencies run hydrometeorological networks in parallel, with minimal coordination of efforts and reluctant exchange of data. Governments may wish to examine institutional arrangements to make agencies more dynamic and product-oriented, to enable them to serve the needs of water resource planners and managers in both the private and public sectors.

Improving transportation conditions

Mobility is an important element in water resources information systems, including hydrometeorological services. Field visits are needed to take measurements, for regular routine maintenance, and to detect and repair malfunctioning equipment. Purchase, maintenance and hire arrangements for vehicles need to be clearly established and adequately financed.

Improving data processing

More effective monitoring of water resources can be achieved by computerized data management and processing. Hardware should be compatible with local support services. User-friendly data processing and effective dissemination of hydrological information are often both needed, and there may be a case for more automation in data collection and transmission.

Establishing a Hydrological Cycle Observing System (HYCOS)

There is a growing need in many countries to collect and process data in a cost-effective and sustainable manner to provide a reliable data base. This means blending and reinforcing the conventional systems with modern technology and equipment, which would offer greater coverage on a regional and sub-regional basis than most current systems. Regional

organizations can play an important role in achieving agreements between countries on joint activities in a region or river basin. A HYCOS system using telemetry and satellite communication would transmit hydrometeorological and environmental data from automatic data collection stations. The data would be collected, transmitted, stored, processed and disseminated by the hydrometeorological services on a daily basis, via an information system linked to both the public and private sectors. The HYCOS system would complement conventional hydrometeorological networks and would also strengthen the capacity of local hydrological services. It would allow the establishment of real-time monitoring of water resources and encourage regional and international collaboration.

Water users, companies and associations

Water users, companies and associations should keep detailed accounts of the water they receive, treat and distribute. This usually entails metering customers, including government agencies, and maintaining a financial accounting system. All of this information will be vital in order to improve demand management, for efficiency analysis and for the monitoring of general overall performance of the water distribution system for all sectors.

THE EFFECT OF TECHNOLOGY ON INSTITUTIONS

Innovation in information technology has presented a challenge to all institutions, including the hydrometeorological services. New technologies have given information a much greater role in economic development, especially in water resources and environmental management. New technologies have brought change because of the speed and scale of information processing and dissemination, the new markets for data applications, the costs and revenues of data collection and the economic value of water resources information. More importantly, technologies are changing the way people think, manage and use information to design, monitor, evaluate and manage water resources on a day-to-day basis.

Chapter 8
The role of economics

The chapter reviews options for and constraints in dealing with water as a scarce economic resource and introducing economic concepts during different phases of strategy formulation. It expounds the concept of water as a scarce, economic good and the criteria for economic efficiency, water values, cost and pricing with application of economic incentive.

It also deals with the essential elements of economic analysis in support of decision-making – evaluating alternative courses and investments, estimating water values and costs, and examining different aspects of cost-recovery. Finally, methodology for economic assessment of projects and programmes and the requirements for improved financial management are presented.

INTRODUCTION

Countries are increasingly recognizing that water not only has a social and environmental value, but an economic one as well that must be managed in terms of both quantity and quality. Economic efficiency – the ability to produce the same or more goods with fewer resources – is a key policy in most countries, one that is directly linked to the conservation of water. Price and other economic incentives are required to conserve water and increase the efficiency of its use. Also, since the least-cost options in water development have largely been exploited in most countries, further major investment in water will in most cases be in the area of water conservation and demand management. Economic analysis is an essential tool in helping select strategy options.

When formulating a strategy, countries should try to determine the *value* of water in different uses. Determining the value of water can be a difficult task, depending on the existing economic data on commodity prices, labour costs and input prices. Projecting such data over the long term is also very difficult. Nevertheless, lack of such data should not compromise strategy formulation. In fact, assessing data availability is the first of the tasks the strategy formulation team should consider undertaking in the area of water-related economics. The others include:

- projecting water demand (and the country's capability for making such projections);
- assessing the economic efficiency of existing water allocation;
- evaluating analytical methods used for water resource enquiries;
- reviewing and evaluating the ability of water pricing and cost recovery policies to meet national objectives;
- assessing the availability and adequacy of private and public capital for investment in water systems; and
- reviewing institutional, legal and regulatory systems.

If economic concepts and considerations are important in Phase 1 of the strategy process, they are absolutely crucial for sorting through the issues and making recommendations in Phase 2. The strategy team will need economic analysis techniques (along with social and environmental ones) to make projections, generate options, analyse impacts of various options, and choose which to recommend to policy-makers.

This section examines the major economic approaches to the valuation of water and the methods used to evaluate water strategies, costs and investments.

APPLYING ECONOMIC CONCEPTS IN STRATEGY FORMULATION

During Phase 1 - strategy formulation (essentially a diagnostic inventory or assessment of water resources) - the strategy team should undertake several tasks related to economic analysis that will be essential for developing and evaluating options in Phase 2. The concepts behind some of these tasks are described in succeeding sections of this chapter. Relevant areas of interest and the related activities include:

- *Data availability* Assess existing sources of economic data and the country's capacity to collect and maintain a data base of key economic information covering, *inter alia*, commodity prices, labour costs and input prices. In addition, assess existing information on water response functions for key agricultural and industrial products, together with domestic water use rates.
- *Demand projections* Review and evaluate projections of water demands by various sectors, and evaluate the country's ability to continue making such projections.
- *Water allocation* Assess the economic efficiency of existing policies and procedures used for allocating water resources within and among sectors, and country capabilities for implementing appropriate water allocation procedures.
- *Analytical methods* Review and evaluate the analytical methods used to assess water resource issues and investments, and the consider possible alternative methods. Assess the country's ability to evaluate alternative combinations of supply and demand measures, including both single- and multi-purpose options.
- *Pricing and cost-recovery policies* Review and evaluate water pricing and cost recovery policies, and past efficiency in water fee collection.

The ability to perform demand projections will be crucial in generating scenarios and evaluating the effects of different choices in Phase 2. Existing projections of water demand might be inadequate; it may be necessary for the water strategy team to make new projections based on population growth, urban development, agricultural policies (e.g., if existing policy calls for crop diversification, what effect will that have on water demand?), water quality considerations and environmental allocations.

Macro-micro economic interactions should not be ignored in the assessment, and coherence with macro-economic, industrial and agricultural policies is important. Sectorial policies affect water use and allocation in non-agricultural sectors in a variety of ways. For example, in the western USA, 70 to 80% of the region's water yield results from snow-melt from the high-elevation forests, many of which are under public jurisdiction. Water yields are significantly affected by timber harvest policies on these lands. Rangeland management policies on lower elevations also alter vegetation conditions and thus affect the rate of evapo-transpiration, in turn affecting streamflow and groundwater recharge. The situation could, however, be more complicated if the uplands are inhabited by ethnic groups, poor rural

communities or displaced people without defined land rights, such as in Viet Nam, India, Pakistan and other countries. In such cases, it is important for downstream city water managers to recognize, understand and become involved not only in the decisions of other sectors such as livestock and forestry, but also in distributional issues between uplands and downstream areas.

With the continuing importance of structural adjustment and stabilization programmes, many developing countries are implementing fundamental changes in macro-economic and sectorial polices. Typical adjustment programmes call for a greater reliance on markets, more open trade, fiscal austerity and a phasing out of producer and consumer subsidies (in input and product markets). Budget-reduction measures imply increased competition between and within sectors for funding new water projects. In these situations, the overall economic, social and environmental implications of choices must be carefully assessed.

In most countries, pressure has increased not only to modify investment allocations but also to recognize and accommodate new demands for water. The direct implications for water managers include fewer capital investments in new water projects, the reduction or elimination of irrigation subsidies, increased efforts to recover true costs, and more emphasis on demand management to improve the efficiency of existing supplies.

One of the important options that should be considered in Phase 2 is implementing a water pricing and cost recovery programme and determining the proportion of operation, maintenance and depreciation costs to be covered in each sector.

Characteristics of water

In addition to the general economic characteristics of water introduced in Chapter 1, there are a number of considerations relevant to strategy formulation and sector programmes.

Inadequate information concerning water supply and demand, which can vary widely within and between years, as well as poor information concerning who actually receives water and how much is used, has, in many cases, made it difficult to effectively manage and price water.

Because water activities have many physical interactions within the ecosystem and with other economic activities, they are often characterized by externalities, i.e., the benefits and costs of production and consumption affect individuals or entities other than those involved in a transaction. Related to the issue of externalities is the limited amount of information available to consumers of water and to consumers and producers of water-related services. The complexities of the ecosystem, the variability of the water supply and the intricacies of the hydrological cycle make it difficult for those supplying and distributing water to consider all aspects; consequently, market prices do not necessarily reflect all these interrelations.

Poorly regulated market systems may generate outcomes that do not satisfy environmental concerns or a country's social goals in terms of poverty alleviation, food security, income distribution and public health. In cases where water resources are transnational or involve transnational environmental effects, water allocation decisions are necessarily made by negotiations among governments.

Economic efficiency and the value of water

Economic efficiency is an important development objective in most countries and this implies that economic incentives are needed to encourage efficient allocation of scarce water resources to those uses that provide the greatest socio-economic benefits for society.

Water values vary widely among different uses as well as within uses. For example, Gibbons (1986) estimated the direct economic value of 1 000 m^3 of water in Tucson, Arizona, in the summer to be $US 302, while the same volume used for navigation on the lower Mississippi River had a value of $US 3. Within uses, she estimated that 1 000 m^3 of water used to irrigate land producing wheat in the Salt River Irrigation project in Arizona had a value of about $US 33; if that water were used to irrigate land for growing carrots, it would have a value of $US 261. Sometimes this is due to the differences in conveyance costs or the costs of transacting a sale or exchange, while in other cases differences exist because water is generally not sold or traded like other goods, especially between sectors. Most trades or sales of water occur within the agricultural sector, usually among farmers in the same village or irrigation system.

Water use may be determined by its first legally recorded use (*prior appropriation* concept) and it may therefore be difficult to change allocations in response to changing economic and social conditions, unless provisions are made to facilitate water trades. In other cases, water is allocated by government administrative decisions; in still others, no one is given a secure and sustainable allocation of water. Where water rights are uncertain or where existing allocation mechanisms cause a misallocation of water resources, higher socio-economic benefits could be obtained through the development of new institutional arrangements that allow a re-allocation of water based on its economic value in different uses.

Opportunity cost and pricing

The task of valuing water to determine price is particularly complex, owing to the limited and very localized nature of water markets. The existence of alternative uses for water which are more valuable than the uses of the target consumers reinforces the case for charging at least an economic price. It is impractical to incorporate opportunity cost into a standard pricing formula because of the extreme spatial and temporal variability in its valuation and the difficulty of dis-aggregating multiple alternative uses. It is useful to distinguish between *valuation* principles - which attempt to rank and prioritize the economic value of usage - and *pricing* principles - which have to be applied in practice. There are only two effective pricing principles: based on the cost of provision of water, and market pricing in an open competitive market. However, pricing policy is subservient to more general economic and social policy, and governments can decide on the level and focus of subsidies applied in either case. Cost of provision can be determined in terms of short- or long-run marginal costs, or on the basis of average costs, depending on context and policy.

Where there is a concern about providing water to the poor at a low cost, block or graduated prices can be used. A zero or low charge can be set for the volume or block of water that is needed to meet a minimum basic health requirement. For the next volume or block of water, a higher price is charged. Also, different prices can be charged for office and industrial uses, and thus introduce an element of cross-subsidization between users.

When it is not possible to charge users a price based on the economic (or even cost) value per unit of water consumed, then quantity restrictions can be used to improve water allocation and use. Although quantity restrictions are less efficient allocation methods than water prices per volume of water used, they do create an implicit price for water. The implicit price forces consumers to use water more efficiently than if there were no restrictions on quantity, since consumers would like to have more water than they receive at the existing charges.

Although *water tariffs* are in widespread use in countries at all stages of development, they are usually seen as a means of cost recovery rather than a way of actively managing

demand. Water costs do not usually include direct and indirect costs for conserving water resources with compensations for limitations to economic activities in the upper catchments. The principles of economic tariff setting are well established and accepted, and are similar to those in use in the power sector. They can be summarized as setting prices according to Long-Run Marginal Costs. This usually entails adjusting the structure of tariffs to include a fixed and variable element, with the latter rising for successive increments (known as *progressivity*).

There is evidence of enough elasticity of demand in the household sector to make tariffs an effective instrument for water demand management. To be able to apply economic tariffs, metering is necessary, which is not always feasible or sensible. It should also be noted that a large proportion of price elasticity studies have been undertaken in the arid western and southern USA, where conservation is readily achieved in amenity watering (gardens, etc.). There is good evidence that demand is inelastic in the winter when there is no amenity demand (Gibbons, 1986). Similarly, consideration of typical developing country domestic water use yields little likelihood of using price for demand management, as existing supplies are clearly inadequate per household.

In irrigated agriculture the use of pricing to encourage efficient use of water is desirable in principle, though fraught with practical problems. Many governments subsidize water as an instrument of food policy. The subsidy to irrigation water becomes capitalized in the price farmers pay for their land. It is impractical to meter water supplied to large numbers of small farmers, who in any case receive a variable quality of service. In practice, irrigation charges, where they are recovered at all, tend to be based on the area irrigated, the type of crop and other proxy measures. Although these methods should not be decried if they contribute to cost recovery - essential to provide funds for O&M - they do not encourage efficient use of the water.

This explains the growing interest in 'devolved' solutions, such as measuring and pricing water delivered to an entire village or WUA, and relying on the latter to recover costs from users and ensure the most efficient use of the water. Alternatively, groups of small farmers, or one large farmer who sells to others, can be metered. It is easy to underestimate the costs involved in implementing the devolution process - witness the cost of some of the national programmes in irrigation management transfer.

The greater devolution of control over pricing and other key irrigation decisions would lead, in the short run at least, to greater variation in water prices between different projects and regions. But this may be a price worth paying if it leads to greater recognition of the value and opportunity cost of water, and improved cost recovery (Sampath, 1992), although political opposition to regional pricing would be expected to be strong in irrigation and vociferous in urban water supply.

The availability of *groundwater* is a complication in pricing surface irrigation water. If the latter is fixed too high, there will be an incentive for increased pumping from aquifers. Once this exceeds the aquifer's natural recharge rate, 'mining' occurs, which can have external costs on society. Heavy pumping from one well may lower the aquifer for all other users of wells in the area. Apart from the short-term costs, the process may be irreversible if the groundwater becomes contaminated.

For such reasons, the coordinated management of surface water and ground water is vital, especially in areas such as South Asia, where groundwater supplies a large part of the irrigated area. An additional complication in managing groundwater is that the aquifer is a common property resource. In the absence of penalties, individual users have an incentive

to overexploit the resource, since the costs fall on all users. By the same token, no one user has any incentive, except for the cost of lifting the water, to abstain from use, since someone else would benefit from this abstinence.

There are various types of *water markets*. Their common feature is that water can be bought and sold, thus enabling it to find its highest value use. Groundwater markets are long-established and widespread in certain parts of the Asian sub-continent, e.g., Gujurat in India, and Bangladesh. Farmers sell water surplus to their requirements to those in deficit. Surface water markets exist in some western states of the USA and in south-eastern Australia, either to transfer water from low-value irrigated farming to urban consumers, or to redistribute water within agriculture. Sometimes the transfers are semi-permanent arrangements, e.g., the efforts of the Los Angeles Metropolitan Water Authority to acquire long-term water rights from its agricultural neighbours.

Water auctions, although unusual, have respectable historical precedent and have recently been tried, with limited impact in Australia. *Water banking* has also been tried: as a response to the recent drought, the State of California bought up water rights from farmers to hold in reserve for urban and industrial use, and most of the stock was drawn down for these purposes.

Other economic incentives

Governments might want to use economic incentives to encourage the adoption of water-saving and re-use technology, and the use of water-saving crops. This can be done by direct subsidies, tax credits for the purchase of certain technology or credit subsidies to purchase water-saving technologies. The amount of subsidies or tax credits should not exceed the economic value of the water saved.

Economic incentives may also be needed to achieve the desired level of pumping and conservation of groundwater. Where there is overexploitation of groundwater resources, fuel taxes may offer a way of achieving the desired level of extraction. The alternatives for managing groundwater are either some form of control by the community of users, or measures imposed by the state. Apart from informal agreements, which are only feasible in small homogeneous communities, the choice of measures is between:

- prices and charges (e.g., volumetric charges based on metering or pumping rates, taxes and price adjustments for fuel or electricity);
- quantity-based controls (permits for new wells, taxes on pumps, specifications for pumps, pumping quotas);
- transferable pumping entitlements (quotas that can be bought and sold within a group of users); and
- incentive subsidies to adopt water-saving technologies.

In view of the problems with monitoring and enforcement, quantity-based approaches may be superior to pumping charges, and can yield economically efficient solutions (FAO, 1993a).

The application of *pollution charges* proportional to the volume and quality of effluent is rare, but has been shown to be effective in reducing water intake as well as discharge. In three industries in Sao Paulo, Brazil, the introduction of an effluent charge led within two years to a 40 to 60% reduction in water consumption (quoted in Bhatia, Cestti and Winpenny, 1994).

Certain societies have successfully used *prescriptive norms,* based on 'best practice' or reasonable usage in each case, reinforced by penal charges for users exceeding these norms. In Tianjin, China, norms are set for industrial consumers based on regular detailed water audits, and users who exceed their quotas pay a penal water charge of up to 50% above the normal level (Bhatia, Cestti and Winpenny, 1994). A similar approach has been used in Israeli agriculture.

Despite the value of economic instruments in improving the efficiency with which water is used, there will always be a role for *non-market devices,* often working in tandem with economic measures. Education and publicity campaigns can help to convert the public to the need for water conservation, though the message will be powerfully underlined by the use of tariffs. In water pollution, some contaminants are so dangerous that they should be banned – pollution charges are not enough. The only feasible response to short-term water supply emergencies may be to ration supplies and ban wasteful uses.

Economic analysis of alternative courses of action and investments

Economic analysis of alternative courses of action is important for economically efficient decisions (Easter, Dixon and Hufschmidt, 1991). It is critical that decision-makers have the facts concerning their possible courses of action. They should know the costs and benefits of other strategies or investments before the decision is made. This does not mean that the decision should be made only on the basis of economics (Hufschmidt *et al.*, 1983). Other social and environmental objectives should be considered when appropriate. While in many cases not all costs and benefits can be measured effectively, decision-makers should have an idea of what it will cost society if they decide to build a hydropower project or allocate water to irrigation instead of industry.

The economic value of water

Estimating the value of water is not easy because its value varies with quality, use, location and time. During dry periods of the year or during drought years, water values will be much higher than in other periods. Moreover, certain seasons or times of the year may also be important (high water values) because of critical water demands for crop growth, heating, cooling, industrial production or shipping.

There are four principal methods of valuing water:

1. Costs of providing the water service to the point of consumption (Winpenny, 1994).
2. Establishing the marginal benefits in terms of its contribution to output (Gibbons, 1986).
3. Calculation of some aggregate opportunity cost, usually by linear programming (World Bank, 1992).
4. Market prices, where water transactions occur.

The value of water to domestic consumers can be estimated based on willingness-to-pay surveys of potential water users, that are then aggregated to measure the demand (Altaf, Jamal and Whittington, 1992; Whittington *et al.*, 1992). The problem is to construct a survey that elicits actual consumer willingness to pay.

In irrigation, the residual return to the crops grown (gross returns, minus all costs other than water costs, but including enough profit to keep farmers in business) provides an estimate of the maximum farmers can pay for the water (Method 2, above). This is an upper bound for the value of water used in producing the crops in question and can be used as an estimate of the value of water when it is the limiting resource. In some cases it may be

possible to develop a more sophisticated analysis of the marginal productivity of water to determine a marginal pricing strategy.

Cost estimation

The other important side of analysis – and the key part of cost-effectiveness analysis, considered below – is the estimation of costs. For any decision regarding water use and allocation, costs must be estimated. For water strategies or investments, decision-makers need to have information concerning the costs (including environmental costs and other externalities) of alternatives.

COST RECOVERY

Another important aspect of the economics of water resource strategies involves the financing of water investments and operations. With the rising costs of water investments and the increased competition for public funds, greater attention will have to be paid to just how investments are to be financed and sustained, with adequate funding for O&M. Aside from finding funds to improve the system, innovative ways must be found to break the old cycle of poor service, low willingness to pay user fees, and inadequate funds for O&M. Current strategies to break this cycle involve turning over the O&M (and in some cases, ownership) of water projects to financially autonomous entities, either public or private and to WUAs. For example, through increased user participation and ownership of water facilities, the Philippines increased cost recovery to an average of 75% of O&M. WUAs are generally in a better position to monitor compliance and to use social pressure to collect water fees from their members.

Before cost-recovery levels can be established for multipurpose projects, joint costs must be allocated to the different purposes (e.g., flood control, irrigation or hydropower). How joint costs are allocated will have a major effect on how much must be recovered from each aspect of a project. For example, there is always substantial political pressure on the Government of the USA to allocate most joint costs to 'non-reimbursable costs' (which are paid by the Federal Government), so that water charges to users are kept low. Joint costs are often allocated by rather arbitrary procedures.

During the next decade the size of water resource investments will probably be beyond the capacity of many developing countries, and additional sources of capital will be necessary (World Bank, 1993a). The mix between private and public capital will need to change; the share of investment from the private sector will need to increase sharply. The availability of private capital will depend on the general level of local capital market development. Viable WUAs should be able to obtain some investment funds from their members (in addition to achieving higher levels of cost recovery than government agencies). Thus, a mix of user charges, beneficiary taxes, central government transfers (grants and loans) and municipal and utility bonds will be required to meet future investment demands.

ECONOMIC ASSESSMENT OF PROJECTS AND PROGRAMMES

Projects and programmes can be formulated in various ways, and the relative economic benefits and merits need to be assessed and ranked. Aside from conventional infrastructure development, a number of non-conventional projects are likely to be considered, such as canal-lining and leakage reduction measures, urban projects to reduce un-accounted-for-water (UFW), subsidies for the use of water-efficient consumer devices, mounting public

information and advice campaigns, etc. Projects carried out in related sectors may also have a close bearing on water supply, e.g., watershed management, afforestation, hill-farming schemes, anti-erosion measures, flood-control devices, etc. As mentioned earlier, it is becoming increasingly important for the costs in related sectors to be reflected in water tariffs.

Cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) were mentioned in Chapter 4. Measurement problems in CBA can be severe, particularly for environmental and health effects, and may force decision-makers to use other evaluation techniques (Dixon and Hufschmidt, 1986).

CEA, which ascertains the least-cost method of achieving predetermined objectives or targets, does not provide any indication of economic rate of return or any information concerning benefits, but identifies the lowest-cost method of meeting the objective or target. It is less time consuming and cheaper to estimate the least-cost solution than to conduct a full cost-benefit analysis. Furthermore, this type of analysis provides a good cost-based decision rule if the decision has already been made that something should be done, such as provision of sewerage.

These two techniques for economic assessment are summarized below, with particular reference to water resources strategy, and the discussion is rounded out by presentation of key points on financial management of programmes and projects, which is fundamental to achieving many of the reforms in water resources management.

Cost-benefit analysis

CBA has been widely used in the water sector since the 1930s to select projects and check their viability in a systematic way. In essence, the costs of a project (capital costs and equipment, land, O&M, periodic replacement, etc.) are entered in each year in which they are incurred. Likewise for benefits, whether they are sales, cost savings, or non-marketed attributes (e.g., flood control) which are valued indirectly. Financial values of both costs and benefits are adjusted to reflect their underlying scarcity value, and the difference between the future streams of costs and benefits is discounted to obtain a present value.

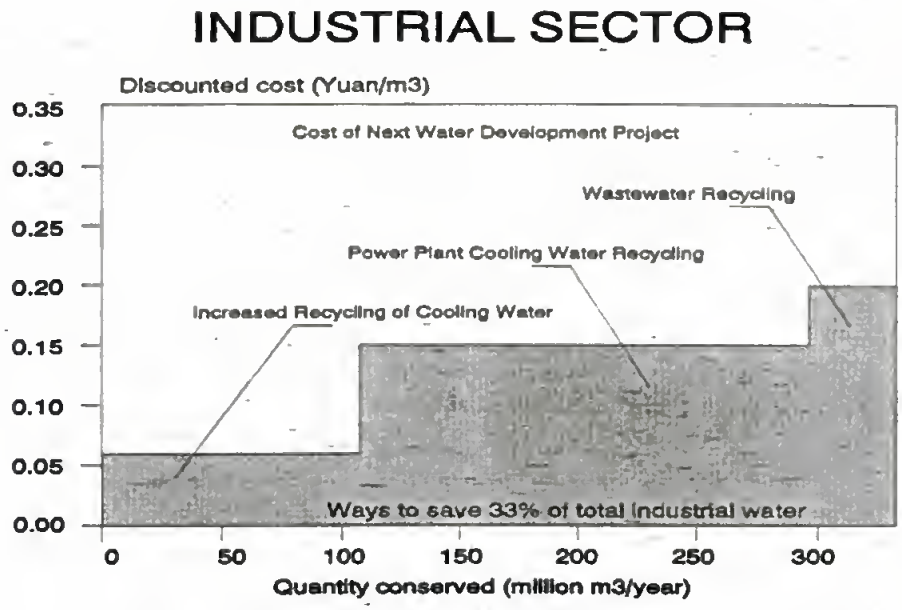
In the context of water management strategy formulation, CBA practice needs to be modified and extended in several ways:

- by applying CBA to both supply-augmenting and demand-management measures in a consistent way. Benefits of the latter include, for instance, savings in the cost of supply, while their costs comprise the forfeit of benefits from using water. This implies some measurement of water benefits;
- the efficiency criterion should be supplemented by the others discussed in Chapter 2, namely efficacy, equity, environmental, fiscal, acceptability, feasibility, and sustainability; and
- both costs and benefits should be extended to include economic measures of environmental impacts, following EIA.

Cost-effectiveness analysis

CEA is applicable where benefits cannot be adequately measured. CEA is also useful in comparing alternative, or cumulative, ways of attaining a given level of benefits. CEA can yield the discounted economic *costs of achieving a unit of conservation.*

FIGURE 5
Supply curves for conserved water in Beijing (quantity conserved vs discounted cost of conserved water (from Hufschmidt *et al.*, 1987)



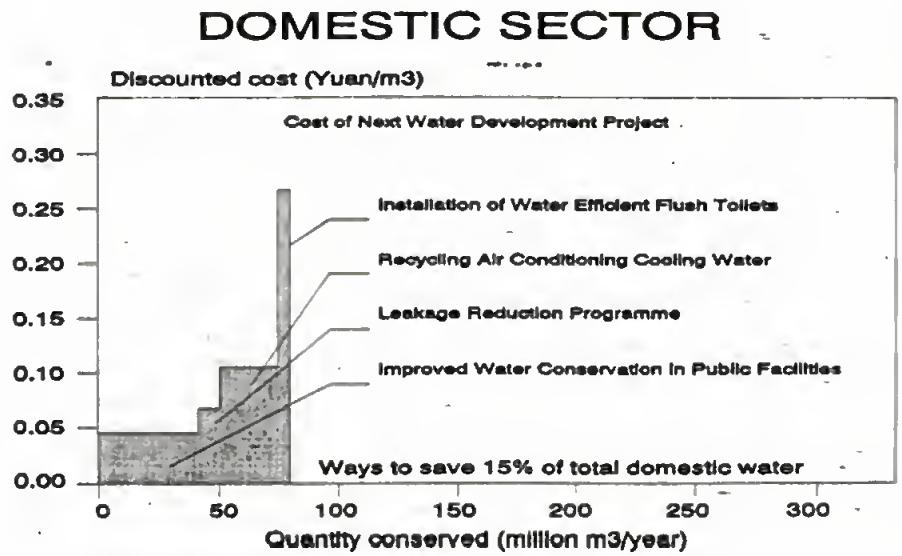


Figure 5 illustrates the results of an exercise into cost-effective ways of meeting Beijing's future water requirements without major investments in new supply sources. It was discovered that one-third of industrial water consumption could be saved by the adoption of three measures: more recycling of industrial cooling water; recycling of power plant cooling water; and wastewater recycling. On a discounted basis, these measures were ranked in that order. They were all substantially cheaper than the obvious next project to develop supply.

In the domestic sector, it was found that four techniques could save 15% of consumption, and each of them was cheaper than the alternative of augmenting supply. These were improving conservation in public facilities; programmes for the reduction of leakage; recycling air-conditioning cooling water; and installing water-efficient flush toilets. If the (discounted) costs and amount of water saved by these measures are arrayed as in the lower graph in Figure 5, they form a 'supply curve' of conserved water.

Financial management

The need for improved financial management in practically every water regime results from several converging factors: poor financial management and inadequate cost recovery has left most utilities decapitalized and underfunded; the cost of new supply schemes is growing in real terms; more stringent environmental standards are driving major investments in water quality improvement; and many old systems, e.g., sewers, are in urgent need of replacement.

These factors point to the importance of:

- cost control within organizations;
- improved pricing and charging systems;
- better collections from users and more stringent penalties;
- developing models for commercializing existing utilities; and
- looking at options for privatizing services.

This in turn requires attention to the following topics, *inter alia*:

- tariffs – incentives, fairness, simplicity and efficiency of collection. Proportion of income to come from charges;
- powers to raise capital from various sources and by various means;
- rules for investment of funds – issues such as balance between risk and yield;
- accounting principles, standards and practices;
- budgetary control principles and practices, e.g., cost-centre and profit-centre accounting; and
- value for money and other audits – principles and practices.

Chapter 9
Environmental and health considerations

This chapter discusses major health, water quality and environmental issues that should be considered in developing a water resources management strategy. The first part briefly outlines some of the health considerations and issues in formulating a strategy. The following two sections review substantive matters pertinent to the water resources assessment during Phase 1 of the strategy formulation process. Although the legal and institutional frameworks for water resources were discussed in Chapter 5, these aspects are such an important part of environmental protection that further consideration is given here. Throughout, discussion is limited to major environmental quality issues.

INTRODUCTION

There is a great variation in individual country's abilities to maintain environmental standards: the wide-ranging powers of the Environmental Protection Agency in the USA have come to dominate water development in recent years (Frederick, 1994), whereas, in contrast, many developing country environmental agencies do not have sufficient power to prevent urban wastewater utilities from discharging raw wastewater back into watercourses. Real world constraints to the development and implementation of environmental legislation need to be thought through, and particular attention is required to ensure complementary legal and institutional development within stand-alone environmental agencies and the respective water services.

PUBLIC HEALTH AND WATER RESOURCES

Public health is intimately linked with adequate water supply and quality and with adequate sanitation. Of eight major diseases or disease groups found in developing countries, four[1] are linked to water supply and sanitation or to vectors that breed in water (World Bank, 1994). Many water projects alter the environment so as to either increase the number of vectors or increase the amount of contact with disease-causing organisms (Tiffen, 1991, 1989).

Attaining a certain standard of public health is often a government objective, and improved public health may be the outcome of government programmes that are not directly linked with water, such as general education programmes, particularly for women (World

1. These are diarrhoea-related diseases (including dysentery, cholera and typhoid); trachoma; tropical cluster diseases (including schistosomiasis, South American trypanosomiasis, and Bancroftian filariasis); and intestinal worms. The other four diseases or disease groups are tuberculosis, respiratory infections, chronic respiratory diseases, and respiratory tract cancers.

Bank, 1994). Of course, many government health programmes concern water directly, such as programmes that are aimed at improving personal hygiene. Public health policy should be addressed by the water resources strategy formulation team, which could include public health professionals.

The assessment should include estimation of the levels of incidence of water-related diseases, their dynamics and some identification of the existing capacity to overcome them (Tiffen, 1991). It is extremely difficult to make reasonable projections of the economic benefits of improved public health, and the strategy formulation exercise should keep this in perspective.

Water-related diseases in developing countries fall into two major categories: those arising from the ingestion of food or water contaminated by excreta, and vector-borne diseases. Malaria is by far the most important water-related, vector-borne disease, in terms both of numbers of sufferers and of directly attributable deaths. Control programmes for vector-borne diseases in many countries emphasize preventive or curative measures, to the neglect of environmental management and community-based preventive measures (Thomas *et al.*, 1993)[1].

HEALTH AND ENVIRONMENTAL ISSUES IN ASSESSMENT OF WATER RESOURCES

Changes in water quality and hydrology due to management and other human impacts may have physical, biological and social consequences - consequences which need to be understood for environmentally sound and sustainable water resources management. The following paragraphs discuss some of the main environmental and health impacts of surface and groundwater use, over-use and quality degradation which should be considered in water strategy options.

Surface water

Stream flow variability

Natural variation in stream flows is a major factor governing the kind of ecosystem that will develop and survive in a given watercourse (Jain *et al.*, 1993). Variation in stream flow affects the amount and concentration of organic and inorganic matter and the rate and location of its deposition. Variation in stream flow also affects oxygenation through surface aeration.

Projects that control, store or divert water modify stream flows in different ways. Flood control projects reduce peak flows, and diversions of water for consumptive use reduce total flow. Low flows diminish a stream's ability to dilute and break down pollutants, and leave downstream reaches more vulnerable. Reduced sediment loads and adsorbed nutrients may affect the productivity in downstream areas such as deltas. Water releases are needed to keep flows at levels above ecological minima and to ensure replenishment of groundwater.

Increased runoff

Land use activities can alter the surface and topography of a basin and profoundly affect important components of the hydrological cycle. Urban development reduces the pervious surface of the land and decreases local groundwater recharge. Impervious and hydraulically

1. Sectorial water policies which may inadvertently affect health or which aim to promote the prevention or mitigation of adverse health effects of water resources development need to be identified and addressed. (PEEM/WHO, 1991)

smooth urban surfaces may result in higher peak flows and greater flood damage. Land use zoning can be introduced to minimize damage from higher peak flows.

Agriculture and forestry also alter soil cover and affect the rate of runoff and percolation in a catchment. Higher flows may increase soil erosion and the amount of sediments transported downstream. Upland erosion is accelerated by processes that reduce vegetative cover in the catchment, such as agriculture, deforestation, overgrazing and forest fires. Areas experiencing frequent flooding, severe erosion or excessive sediment deposition should be delineated in the water resources assessment.

Surface water quality

All natural water bodies have the capacity to assimilate some level of waste without apparent damage (Jain *et al.*, 1993). This capacity is due to physical and biochemical processes that break down waste into harmless substances, but negative impacts become significant once the threshold is exceeded. Pollutants enter water bodies from 'point' or 'non-point' sources. Examples of point sources include municipal and industrial wastewater and runoff from municipal dumps, and agricultural sources such as feedlots and poultry farms – all discharging into streams, lakes and oceans. Non-point contamination includes rural wastewater, nitrate pollution of groundwater, and pesticide accumulation in runoff. The characteristics of major point and non-point sources are explored below (see Robbins *et al.*, 1991).

The main point sources of pollution are municipal and industrial wastewater. Partially treated and untreated discharges are a major source of nutrients like nitrogen and phosphorus, bacterial pathogens, viruses, parasites and organic contaminants. Nutrients can accelerate algal growth and eutrophication in water bodies. Water supplies contaminated with bacteria, parasites and viruses may affect downstream users and incur higher treatment costs. Industrial effluent can affect water in many ways, from changing the temperature (thereby altering sensitive biochemical processes) to harming and even destroying aquatic ecosystems by direct effects of toxicity or by raising biological oxygen demand.

Major non-point sources of contamination include urban and agricultural runoff, forestry management, and mining. Urban runoff may contain suspended solids, heavy metals and organic contaminants (FWPCA, 1969). Agricultural runoff can carry suspended solids, salts, nutrients, organic loads, pesticides and pathogens. Suspended solids are the largest pollutant category to affect surface water and many of the aforementioned pollutants may be adsorbed onto soil particles and thus be carried to surface waters. Irrigation return flows may contain high concentrations of suspended and dissolved solids, pesticides and trace elements. Irrigation-related salinity is a serious problem in arid and semi-arid areas. Other agricultural non-point sources of pollution include grazing areas and ranches. Forestry management activities such as logging and clear-cutting may increase surface runoff and reduce groundwater replenishment. Mine effluent contains metals and other substances that can alter the pH of surface waters, and this can dramatically harm sensitive species.

Sensitive ecosystems

Modifications to hydrology and water quality may have the greatest effect on wetlands – marshes, estuaries, coastal zones and inland lakes (see Dugan, 1990). Wetlands are productive ecosystems and are important in preserving biological diversity, providing buffers against floods and also serve as natural water purification systems. Low streamflow conditions decrease wetland areas and subject them to more concentrated pollutant loadings.

Estuaries are important nurseries and staging areas for many species of shrimp, fish and waterfowl. Low stream flows with high contaminant concentrations degrade estuarine

habitats and may also change the balance of fresh- to salt-water, possibly resulting in saline intrusion into a coastal aquifer.

Coastal zones form important habitats for shellfish and perform important functions in nutrient cycling and waste treatment (World Bank, 1991). Coastal zone ecosystems can be affected by municipal and industrial waste discharges, pollution from urban and agricultural runoff, destructive fishing practices (e.g., using dynamite) and dredging.

Inland lakes are important sources of water supply and provide benefits such as fishing, navigation and recreation. They can also influence the local climate and the groundwater regime. Waste discharges can have dramatic effects on the populations of fish, other aquatic species and plants. Nutrients from municipal wastes and agricultural runoff can accelerate algal growth and eutrophication, leading to increased turbidity levels, taste and odour problems, and can deplete dissolved oxygen, creating anoxic conditions in the deeper parts of the lake, which can affect many fish and other species. In severe cases, algal blooms may release harmful toxins, resulting in fatalities, as occurred in Australia in 1993.

Effects on public health

Partially or untreated urban wastewater entering surface waters and groundwater can spread diarrhoea, cholera or other waterborne diseases. Such public health hazards can be exacerbated under low-flow conditions, when wastes become more concentrated, prolonging the survival and growth of pathogens.

Groundwater

Groundwater pumping can induce the inward migration of poor quality waters from adjacent areas. Inter-aquifer movement of poor-quality water can occur when there is a difference in the hydraulic head across aquifer boundaries, through well screens, perforated casings or open boreholes. Overextraction could cause permanent decline in groundwater levels and over-pumping from freshwater aquifers overlying salty waters can lead to saline contamination by upwelling.

Effects of rising water table

Irrigation can cause waterlogging which then results in salinization if the deep groundwater is saline or contacts naturally saline strata. In dry climatic zones, waterlogged soils concentrate salts in the plant root zone and it may not be possible to reclaim soils unless drainage is installed and accompanied by suitable management practices at an early stage.

Groundwater quality

Groundwater systems have some ability to purify themselves; this depends on the material and properties of the aquifer. Self-purification occurs largely through the filtering action of water infiltrating the aquifer material and also through biochemical processes that may be influenced by the level of available oxygen and the type of substrate material.

A variety of chemicals can contribute to groundwater contamination. Salts, fertilizers and agrochemicals such as insecticides, herbicides and fungicides used in agriculture may be leached to groundwater. Other sources of contamination include surface disposal of liquid wastes, septic tanks, leaking sewers and underground storage tanks, industrial wastes and oil-field brine disposed of through injection wells, as well as mining wastes (Everett, 1990). Remedial action is generally more difficult and therefore more expensive than treating surface water pollution because aquifer properties and behaviour are harder to understand and define. Contaminated areas and aquifers that are highly vulnerable to pollution should be noted in the water resources assessment.

Priority environmental issues

Water pollution and over-allocation of water resources are the two principal causes of conflict among competing users of water. Such conflicts invariably affect the poor and the environment. Excessive surface water diversion and groundwater pumping result in low downstream flows and basin depletion respectively.

Allocation of water resources

Over-allocation of water is often a result of poor planning, poor management decisions or undue influence of vested interests. Environmental allocation should be safeguarded and incorporated into river basin management plans.

Pollution control

Pollution from point and non-point sources affects all beneficial uses. Controlling waste discharges from point and non-point sources should be a priority objective for protecting surface water and groundwater quality. This would first require identifying major point and non-point sources and loads, then reviewing and using the various instruments (standards, permits or incentives) for controlling waste discharges and, finally, monitoring changes in pollutant loads to enforce compliance and determine the effectiveness of the controls to meet the water quality objectives adopted for surface water bodies and underground aquifers.

Specific environmental needs should be incorporated into the information system activities described in Chapter 7. Discharge, water quality and waste discharge data collected at low and high flow periods in major tributaries and streams can be collated to estimate the proportion of pollutant loads originating from different sub-basins or point sources. Priority basins or geographic areas to be targeted in the short term should be identified in the country water resources management strategy. In addition, priority investment needs for pollution-control infrastructure should be identified.

WATER RESOURCES ASSESSMENT: ENVIRONMENTAL INSTITUTIONS

Protecting and preserving the environment can only be accomplished with effective institutions backed by adequate legislation and policies. The effectiveness of water-related environmental institutions should be examined as part of the country water resources assessment.

Environmental policy articulates principles to ensure that economic development occurs in an environmentally sound and sustainable manner. It could be based on broad principles or on pragmatic concerns recognizing that prevention of adverse effects is less costly than restoring damage. Policy may be implemented through procedures for recognizing environmental consequences of a proposed action (for example a flood control project) early in the planning process and for considering such consequences in decision making.

A policy's success may depend on how well it is articulated and the extent to which is practical and achievable. Addressing the goals of development and environmental sustainability and the trade-offs between them, especially in the context of a nation's social and cultural traditions, will be central to the success of economic development (Ahmad and Sammy, 1985).

BOX 8: CHECKLIST FOR ENVIRONMENTAL IMPACT OF WATER DEVELOPMENT PROJECTS

IS THE PROJECT LIKELY TO:	Yes	No	Not known
1. affect any natural feature, surface water hydrology, surface water quality, soils, erosion, geology, climate or water resource adjacent to the activity area?			
2. effect wildlife or fisheries?			
3. affect natural vegetation?			
4. affect or eliminate land suitable for agricultural or timber production?			
5. effect fisheries or aquaculture resources or production?			
6. effect the quality of water resources or catchment areas within or adjacent to the activity area through change in the water supply downstream of irrigation or through human or animal toxins?			
7. effect air quality in the activity area or adjacent areas?			
8. require relocating the existing population, community facilities, and housing?			
9. lead to changes in the supply of, or demand for, infrastructural items?			
10. cause substantial change in income and traditional source of livelihood of existing population?			
11. include provisions to investigate the impact on regions where resettlement is occurring?			
12. result in potential conflicts or affect physical, demographic or attitude/value cohesion?			
13. effect archaeological sites or structures of historic or cultural significance?			
14. induce or exacerbate erosion in the watershed area?			
15. exacerbate water rights conflicts?			
16. provoke a significant reduction in downstream flow, impairing aquatic life or endangering wetland water supply?			
17. create or exacerbate disease hazards?			
18. be designed without prior consultation or participation of affected populations?			
19. provoke a shift in crop pattern in the region?			
20. provoke a shift from low-input to high-input farming practices?			
21. ignore provisions for post-project monitoring?			
22. require long-term extension services?			
23. be formulated outside the framework of a global strategy for development?			
24. induce new migration towards the projects area (around reservoirs)?			
25. be implemented in the absence of a training programme on techniques for more efficient water use?			
26. create or exacerbate soil salinity problems?			
27. be designed without adequate drainage facilities?			

Source: A guide to the environmental assessment of irrigation and drainage projects in developing countries (FAO, in preparation)

Legislation

Legislatively mandated policies are more likely to be implemented successfully than those that are not. The relevant legislation may be enshrined in a Water Act, a Water Pollution Control Act or environmental legislation, and may be supported by codes of practice and public health standards. Direct regulation based on effluent standards, including the issue of permits or licences, is often used to control point-source discharges. Zoning regulations have been used for controlling non-point source pollution in urban areas. Controlling non-point sources from agriculture and forestry management activities may require watershed and catchment area management programmes in which soil and water conservation is an explicit objective. Broad-based environmental legislation can provide a framework for an integrated approach to regulate development activities that affect environmental quality and may require the introduction of EIAs for all major projects and programmes.

Priority institutional issues

Effective environmental management in the water sector will require agencies capable of administering well-defined regulations. Likely recommendations to policy-makers include:

- institutional strengthening by establishing a clear political mandate for environmental protection;
- strengthening existing legislation and agencies involved in monitoring and compliance activities;
- introduction of enforceable penalties and regulatory techniques;
- examination of economic incentives, especially for treatment provided by polluters themselves;
- mandatory EIA for major development projects;
- establishment of appropriate standards; and
- financing of environmental programmes, possibly through pollution tariffs.

Environmental impact assessment

An EIA is a policy instrument that has been used in many countries for fostering sustainable water resources management and which also gives a voice to those who will be affected by a development or change of management practice. Details of EIAs can be found in the World Bank's *Sourcebook* of 1991, and a sample checklist (FAO, in preparation) of the issues in water development projects is presented in Box 8, opposite.

Water poses particular difficulties in that it is a cross-cutting issue arising in a number of other sectors, hence no single checklist can suffice. In assessing how water will be affected by developments in other sectors, the relevant checklists and assessment guidance for those sectors should be consulted, e.g., in the World Bank's *Sourcebook*, or the FAO guidelines (FAO, in preparation).

Where information on a potentially important topic is not available, this indicates the need to commission an EIA. Decision-makers should equip themselves with the facts about the type of environmental impacts at stake, their potential seriousness, how they could be mitigated and at what expense, and whether there are alternative ways of achieving the same objectives at less environmental risk. Further guidance is available from FAO (FAO, in preparation) on the conduct and application of environmental assessment in the water sector.

Project-specific EIAs should be required for most investments in water supply, flood control, irrigation and drainage, sewage treatment and power generation. Regional EIAs can be used for multiple projects, such as a series of dams, planned or proposed in a localized geographic area, or for river basin planning. They may also be useful for identifying conflicting demands on resources imposed by different projects (for example, the cumulative effect on water quality of several municipal and treated industrial discharges) and for designing mitigation measures (World Bank, 1991). In this way the EIA process can be used to (a) incorporate cross-sectorial actions needed to properly manage the water environment, (b) spur consultation and coordination among sectorial ministries, and (c) achieve restoration and protection of the water environment.

Sectorial EIAs may be suitable for reviewing investment options and for evaluating new policies, for example water conservation programmes. They may also be used for assessing the institutional requirements for performing environmental reviews, environmental management and developing monitoring programmes (World Bank, 1991).

Coordination

The effective management of water resources will depend on the ability of the government to bring together diverse interests and integrate them in decision making. Such integration should begin with strategy formulation and continue to project planning, design and implementation. Coordination will be especially vital for integrating the complex cross-sectorial environmental issues. The principles and techniques outlined in the section on stakeholder participation and human resources development can be readily applied to the environmental aspects of water strategy formulation.

Chapter 10
International issues

This chapter suggests how international considerations can be included in the process of formulating a national water resources strategy, and presents some of the main considerations that arise in the setting up of collaborative arrangements between basin states. It draws on experience in international law concerning the use of transnational water resources. Finally, the chapter discusses pertinent aspects of river basin organizations (RBOs) and the concept of joint commissions for managing water resources. Many of the suggestions and principles in this chapter apply not only to international waters but also to national waters that flow between provinces or regions.

INTRODUCTION

Water does not respect borders, and the formulation of a water resources strategy must explicitly recognize any international issues that may exist in surface waters or groundwater management. Over 200 river basins are shared by two or more countries and the increasing importance attributed to river basin management (as stated in 1992 at ICWE and at UNCED) requires formal collaboration in addition to co-operation and good-will. For example, the principal surface water resources of practically all countries in continental sub-Saharan Africa are international. In the former Soviet Union, several major rivers have become international with the partition of that country into numerous independent states. Cooperation and goodwill among states sharing a drainage basin are both of them essential for efficient development and utilization of international rivers and groundwater aquifers. In order to fulfil their own economic development goals, it is important that such states formally collaborate to exchange data, share waters, preserve the environment and generate development programmes that are of joint interest and benefit.

INTERNATIONAL ASPECTS OF WATER RESOURCES STRATEGY

If the international aspects of the resource deserve significant attention, it should be immediately obvious to the group charged with formulating a national water resources management strategy. In general, the process of assessing water resources (Phase 1) should be similar in most countries; for some, dependence on international sources will be a major issue and therefore the chief question in developing and choosing options (Phase 2) is how to most efficiently (and equitably) manage such resources.

It may be that formulating a national water resources strategy without directly involving neighbouring riparian countries would be fruitless and thus some countries may engage in joint strategy formulation from the outset. At minimum, the strategy team may wish to review existing international treaties and institutional arrangements and suggest

realistic options if change is required. The strategic plan might suggest areas of further collaboration among riparian states.

INTERNATIONAL WATER LAW

The main initiatives in international water law have been taken by the International Law Association (ILA, an NGO) and the International Law Commission (ILC, a subsidiary organ of the General Assembly of the UN). The ILA became engaged in water resources in 1954 which led, in 1966, to the formulation of the well-known Helsinki Rules on the Uses of the Waters of International Rivers. The ILA has since published a number of corollaries to and clarifications or completions of the Helsinki Rules, including some modifications to their application to groundwater. The ILC was initially oriented toward navigation, and took up the study of non-navigational use of international watercourses in 1970.

The Helsinki Rules are widely adopted as a basis for international negotiations and collaboration on river basin development. They embrace the concept of the international watercourse, for which water resources, whether passing international boundaries or entirely within one country, are treated as the common property of all basin states. Furthermore, they rest on the principle that each basin state is entitled to equitable utilization while not causing appreciable harm. Among the relevant factors determining 'equitable utilization', the Rules list the geography, hydrology and climate of the basin in each state; past and existing water users; social needs of each state; costs of development; and the degree to which the needs of a basin state may be satisfied without causing substantial injury to another.

There has been little serious criticism of the value of the Helsinki Rules as a basis for negotiation. Some feel, however, that the 'drainage basin' is not always the appropriate spatial unit and others have suggested that the full application of the Rules can detract unduly from the autonomy of a basin state. The ILC has adopted the terminology of 'international watercourse,' which designates rivers, lakes, glaciers and underground waters and is founded on the idea of 'international watercourse systems', which constitute a unitary whole and a shared natural resource.

There are two substantive principles that emerge strongly from the Helsinki Rules and from the work of the ILC and that now receive general acceptance in international rules. They are:

- a prohibition of appreciable harm by way of deprivation of water rights, pollution or other means; and
- the right of each basin state along an international waterway to a reasonable and equitable utilization of its waterway.

OBJECTIVES OF COLLABORATION

The primary objective of international collaboration between basin states is often perceived to be the resolution of conflicts. This should be a position of last resort. The primary objective must be to develop the resources of a drainage basin for the mutual benefit of its several connected states. If that objective is achieved, potential conflicts can be avoided or they may resolve themselves.

Whatever objectives are set, they should fit into a carefully constructed strategic framework that includes realistic priorities from the standpoint of all participating basin

states. Several international endeavours have failed to achieve their aims because their specific objectives were either too ambitious in the first place or they did not represent true priorities for the member state, or simply because there was no workable water sector policy in place in one or more of the basin countries. There is evidence that the most successful endeavours in international collaboration are those that

- focus on well-defined objectives, such as water sharing (for example, the Indus River Basin Agreement between India and Pakistan) or the construction of specific common works, such as the Kariba Dam on the Zambezi River;
- develop projects that are of joint benefit to several or all of the basin states; and
- develop projects that form part of a long-term integrated river basin plan.

Although integrated water resources planning is even more important at an international scale, the technical and physical aspects assume considerable significance in the need to:

- integrate the several potential sources of water – surface, ground, reclaimed and de-salinated – as appropriate;
- integrate water supply and wastewater disposal; and
- control pollution at appropriate levels.

Until recent years, little attention was given to groundwater and its conjunctive use with surface water, although it is very much an active issue in the development of water resources agreements in the Near East. International law on transboundary water pollution (such as salinity) is weak and poorly codified. The resolution of pollution problems depends very much on negotiation of agreements between countries or autonomous provinces. One good example is the Murray-Darling Basin Treaty between four States in [Federal] Australia. Both parties to the Indus Treaty developed separate water resources assessments and preferred options at a national level, which were then rationalized into the final agreement. This process was thought to result in a stronger sense of ownership by both parties, although it involved considerable time and negotiation.

ACCESSING THE DATA BASE

A good data base, including hydrology, land resources, demand projections, inventories of potential development projects and environmental conditions, is essential to any international dialogue on water affairs. Equally important is that there should be compatible information sharing and planning procedures between riparian neighbours.

Most principles governing data measurement, retrieval, and processing (as discussed in Chapter 7) apply equally to national and international drainage basins. The important difference for international rivers is that there is a distinct need for frequent exchange of data between basin states so that apparent discrepancies in either the raw data or its processing can be identified at an early stage. In several international river basins, there has been an unwillingness to exchange data and information unless such an exchange is established by formal agreement. Article XXIX of the Helsinki Rules recommends that

> "... each basin State furnish relevant and reasonably available information to the other basin States concerning the waters of a drainage basin within its territory and its use of, and activities with respect to, such waters."

Data is generally collected on a national basis by each basin state. In some cases, specific data is collected regionally by a jointly formed RBO or other agency. The choice depends

on local conditions and the nature of the data. Thus navigation data on the Mekong River was collected by the Mekong Secretariat, an RBO, and boundary surveys in Lake Chad have been carried out under the auspices of the Lake Chad Commission (an RBO), whereas hydrological data in the Lake Chad basin are collected as a national activity by the basin states.

WATER SHARING AND ALLOCATION

Water allocations are made in various ways according to circumstances. In some situations, like the Indus basin, water may be shared by the allocation of the complete flow of a sub-basin. More usually such 'block' allocations are not feasible and water sharing is on a proportional basis. This is the case with the Nile between Egypt and Sudan and with the Komati River between Swaziland and South Africa.

For the purpose of international agreement there is a strong case to be made for measuring water allocations at a specific point (for example at Aswan for the Nile) and to adjust, by an agreed formula, for transmission and operational loss to the point of abstraction. It is important to take into account **all** significant water uses and return flows in preparing the balance sheet that will form the basis of a treaty. These include not only the main direct uses of water for rural, urban, industrial, recreational and irrigation purposes, but also evaporation losses from reservoirs and return flows from irrigation and from urban and industrial uses.

Water allocations to different sectors are assigned different assurance levels. For example, urban supply may be 98% or even 100%, against 65 to 75% for irrigation. The right to convert one allocation to another by a predetermined conversion factor is often formally included in agreements.

General rules for water rationing during extreme droughts need to be incorporated in treaties, but the responsibility for detailed operations during such events may be more appropriately assigned to an RBO established specifically for the operation and maintenance of any common works.

INTERNATIONAL RIVER BASIN ORGANIZATIONS

The scope of the terms of reference of a RBO can cover all or any of the following activities:

- data collection;
- planning;
- water allocations;
- raising funds for studies and project implementations;
- project cost sharing;
- implementation of projects;
- O&M of projects; and
- monitoring water use, control of pollution and preservation of environmental conditions.

RBOs vary from joint commissions concerned with little more than water sharing to organizations that have major executive functions. Examples of the former are the India-

Pakistan and Sudan-Egypt joint water commissions, and, of the latter, the Senegal basin's OMVS, which performs almost all the functions listed above. It is desirable, if not essential, that an RBO operate continuously so that any issue between basin states can receive immediate attention. It may be more expedient and logical to separate the policy- and strategy-level responsibilities from the executive actions and implementation programmes. For example, a joint water commission might be formed as the main policy body with a wide brief that may encompass all drainage basins shared by the member states. An RBO might then be established in the form of a corporation with a full legal status with specific responsibilities to execute, operate and manage specific projects.

Experience worldwide indicates four key requirements for the establishment of an effective RBO:

- political and financial commitment on the part of the member states;
- clear definition of what the member states require of the RBO;
- defined procedures for interaction between the RBO and the national agencies; and
- an organization, incentive structure and staff that are compatible with its responsibilities and its legal status.

International water resource issues remain an area of great challenge and are a focus of continued hard work and innovation.

Chapter 11
Water strategies in practice

This chapter illustrates the nature of water resources strategies, drawing on actual cases in Chile, England and Wales (United Kingdom), France, Indonesia, Mexico, Turkey, Victoria (Australia) and Yemen. Particular attention is paid to the process of policy review, and how public consultation was organized. The outcomes of reviews are discussed under the headings of reforms in water rights, privatization and corporatization, the promotion of prices and market mechanisms, and reforms in planning and management.

The intention of this chapter is not to offer prescriptive guidance on how to mount water policy reviews, but rather to give readers the flavour of a number of such reviews that have actually been carried out. It is only realistic to recognize that every country will wish to conduct reviews in their own way, responding to national differences in basic problems, cultural, legal, historical, political and institutional peculiarities, stages of development, professional and administrative capacity, and other fundamental factors. Hence this guide does not prescribe blueprints.

WATER POLICY REVIEWS IN PRACTICE: COUNTRY EXPERIENCES

Table 3 contains examples of water policy reviews conducted recently by seven countries at various stages of development. Some issues of common interest are discussed below under the headings of review processes and main outcomes.

Review processes

A common problem in approaching the review is that the water sector is large and diverse, and responsibility for it is fragmented, or at least divided amongst several agencies. Hence one of the first decisions to be taken is how the necessary coordination of information and views should occur. Despite having a Central Water Council, *Yemen* found it expedient to appoint an interdisciplinary task force reporting to an Advisory Committee chaired by the Vice-Minister responsible for Water Resources. The Advisory Committee contained senior officials at Deputy Minister level from all water-related ministries (Box 9).

In *Indonesia* the review was organized as a major multidisciplinary study by the Directorate General of Water Resources Development. It was supported by national and international expertise in water management, economics, legislation and institutions (Appendix 1). Likewise in *Chile* the review process started with a technical study carried out by the Water Department of the Ministry of Public Works. In Mexico a National Water Commission was created in 1989 with decision-making powers over the allocation of water. The Commission steered through the important 1992 legislation. In *France* a National Water Committee, a consultative body comprising representatives of Government, water users and elected officials, took part in the final stages of the process leading to the 1992 Water Act.

TABLE 3
Examples of water sector policy review

COUNTRY	WATER POLICY REVIEW: STEPS TAKEN				
	1. Justification for review	2. Initiatives taken	3. Draft policy document/public consultation	4. Main thrust of policy review/ reform	5. Final documents and action
England and Wales (United Kingdom)	1985: Conflicting issues of financial management of public Water Authorities.	1986: Government white paper on privatization of water industry; then various reports prepared.	Release of consultation policy papers for Parliamentary review.	Redraw boundary between the public and an integrated private sector. Control of a privatized water industry.	1988: Water Bill released. July 1989: Water Act enacted by Parliament.
France	Supply-demand imbalance worsened by drought.	Creation of National Water Committee. Regional seminars. National Water Seminar (March 1991).	Discussion of policy proposals at National Water Seminar.	Manage water resources in an integrated and balanced manner. Balance water resources development/conservation.	Law on Waters enacted by Parliament in January 1992.
Chile	Critical level of water resources deficiency; conflicts between the administration and the private sector on socio-economic and property issues.	1990: Government initiates review of water policy. August 1991: National Seminar.	Discussion of policy proposals at National Seminar.	Balance public and private sectors' roles; enhance tenure security of water rights.	Draft water resources legislation tabled in Congress (1992).
Mexico	Growing regional imbalance between water demand and availability of water to cities and to irrigation.	1989: Creation of the National Water Commission. Review of water policies.	Document outlining Water Policies and Strategies released and disseminated by National Water Commission (Dec. 1990).	Promote water use efficiency; improve quality of water services through enhanced role of the private sector.	Law on National Waters enacted by Federal Congress in November 1992.
Victoria (Australia)	Public impatience with a bureaucracy out of control and spending of public money without proper supervision.	1980: Public Bodies Review Committee set up to advise on policy. 1988: Independent Committee of Review set up to scrutinize proposed new water legislation.	1981: Committee recommendations released. 1986: Discussion Paper and Issues Papers for new legislation released. Workshops, public meetings held.	Rationalization of water management bodies. Restructuring of central water administration. Legislative reorganization. Corporatization of public sector agencies.	Water (Central Management Restructuring) Act enacted in 1984. Water Act enacted in December 1989.
Yemen	Over-exploitation, low-efficiency use and fast degradation of groundwater resources; institutional fragmentation resulting in conflicting draft water legislation.	1992: Government's comprehensive water resources policy review under inter-ministerial Advisory Committee and National Task Force.	Inter-sectorial and inter-regional working groups.	Conservation and sustainable utilization of water resources; environmental protection.	Task Force's comprehensive report and policy studies; national seminar on water policy; a National Water Seminar in 1993.
Indonesia	Re-orientation of large public investment, with high water subsidy, deterioration of water resources infrastructure, regional supply-demand imbalance, water use changes.	1987: Irrigation sector policy. 1991: Government's comprehensive water policy review; creation of private sector organizations for water resources management.	National and international seminars on water management policy. 1994: Draft water policy and policy action plan for 2nd 25-Year Plan.	De-centralized water administration based on river basins; privatization and cost-recovery; cross-sectorial analysis; regional water resources development.	Water policy in 2nd 25-Year Plan and VIth Development Plan. De-centralized water administration.

Sooner or later in democratic regimes a public discussion paper on water policy will need to be released. Its purpose will be to inform the general public and interested parties of the problems and issues, indicate the main lines of proposed policy reforms, and invite comment and consultation. In *England and Wales* (United Kingdom) the ground was prepared by the release of several official documents, starting with a White Paper and two consultation documents in 1986, a proposal for the National Rivers Authority in 1987, and a further White Paper in 1987, reflecting the reactions to the earlier one.

Chile also distributed a basic document on national water policy to agencies and departments involved in water resources management. After receiving comments, a version of this was considered at a national seminar in 1991 involving officials, academics, professional associations and water users. *Yemen* also used the device of a National Seminar for final review of the draft National Water Resources Policy document. Likewise, in *France* a series of seminars were conducted in the various regions for all potentially interested parties, especially farmers and local officials. The results of these seminars were considered at national water seminars (Assises nationales de l'eau) in 1991.

BOX 9: THE REVIEW PROCESS IN YEMEN

In response to increasing fragmentation and largely uncontrolled or private-user-based water resources management, the Government of the former Yemen Arab Republic had established a Central Water Council under the auspices of the Ministry of Water and Electricity. It had, however, become increasingly clear that water management in Yemen, working in a policy vacuum and without regulatory systems, was not sustainable, leading to fast depletion and degradation of the resources, with increasing incidence of water conflict. *Ad hoc* drilling and non-sustainable abstraction of groundwater at increasing depth tended to lead to increased water cost and uneconomical uses. As a consequence of water users maximizing their income by appropriating other people's resources and shifting their own costs onto society, the groundwater resources were being depleted, resulting in decreases in food production. Scarce water resources were also being used inefficiently and well-functioning customary and tribal systems were replaced by inefficient bureaucracies.

Policy intervention was therefore necessary to unify the water sector and bring competitive economic forces into play to protect the resources. However, policy implementation would be limited due to insufficient and poor institutional framework and human resources, absence of inter-sectorial coordination, and lack of analytical tools, adequate and reliable data, effective policy instruments, mechanisms for R&D and adaption of new technologies.

Following unification in May 1990, the Government had not been able to agree on a basic water policy and institutional frameworks, including a basic water law, and in 1991, faced with two contradictory proposals for water legislation, the Government assigned the minister responsible for water resources the task of developing a coherent water policy as the basis for consensus on legislation and institutional frameworks for water resources management. An issue- and objective-based water policy was developed following a double track approach.

A national interdisciplinary water policy task force was set up with representatives from the various water subsectors. The task force developed draft water policy, reporting continuously to an Advisory Committee. The Advisory Committee was chaired by the Vice Minister, and had as members senior officials at Deputy Minister level from all water-related ministries. In this manner, a comprehensive draft National Water Resources Policy Document, including proposals for institutional arrangements for water resources management, was prepared for final review in a National Seminar, and consideration and approval by the Council of Ministers. The policy, when approved, will form the basis for a national water legislation and administration, and strategies and programmes in the water sector.

BOX 10: THE WATER REVIEW PROCESS IN VICTORIA, AUSTRALIA

The process of developing the new Water Bill in the period 1985-89 had the following elements:

- ***A Discussion Paper***, identifying principles and options. The review began in earnest early in 1985, in response to perceived deficiencies identified by stakeholders over the years. Various options for developing a modern legislative framework were canvassed in a Discussion Paper, released in September 1986.
- ***Issues Papers***. Over the following few months, six Issues Papers were released, each floating more intricate or innovative proposals in greater detail. One explained, in simple terms, the historical development of common law and statutory provisions concerning private rights in water, demonstrated existing anachronisms and explained how they could be solved. Another set out the principles of a system of transferable water rights, how such a system might operate and what benefits might be expected.

  Proposals for rationalizing the powers of different types of Water Boards were similarly explained. Other papers dealt with dam safety, drainage issues, groundwater, and proposed procedures for objecting to, or appealing against, administrative decisions. In each case, the papers were widely distributed and written submissions and comments solicited.
- ***Public Consultation***. There were several distinct avenues of consultation. First, the Rural Water Commission, with assistance from the Victoria Farmers' Federation, held intensive, small group workshops with irrigators at 22 different locations, to discuss a possible system of transferable water entitlements. The various Water Boards were assisted by two teams to help them understand proposals, and to develop operational plans for Ministerial approval. Finally, early in 1987, 17 public meetings were held in different parts of the State to discuss issues known to be of particular local concern, to answer questions raised by the audience, and to invite further written submissions.
- ***Feedback***. Issues raised at each of the irrigators' workshops and public meetings were reported back in a series of Consultation Newsletters. Further written submissions were solicited. More than 150 submissions resulted from the irrigators' workshops and hundreds more from public meetings.
- ***Draft Proposals***. After consideration of the results of consultation, Draft Proposals for a Bill were prepared and released in July 1988. This document was widely circulated, with a call for further comment and submissions.
- ***The Independent Committee of Review***. In a naval move, designed to improve political support for the Bill, the Minister appointed an independent committee to review the Bill and take into consideration all comments and submissions made.

  The Committee comprised nominees of the Australian Conservation Foundation, the Water Authorities Association of Victoria, the Victorian Farmers' Federation, the Institute of Water Administration, the Association of Victorian River Management Authorities and the Australian Water and Waste Water Association. A further appointee was a retired member of the Victorian Soil Conservation Authority and a grazier. The Deputy Chair was a country solicitor, with a practice in water matters, and it was Chaired by a Government member of Parliament who had formerly been a farmer and an irrigator.

  The Committee distributed almost 3 000 copies of the draft Bill and advertised widely for submissions, receiving almost 150, half of which came from water or sewerage authorities or their representative organizations. The Committee considered matters of principle and issues of major concern in the submissions made. In the five months available to it, it was unable to deal with all matters of detail raised in submissions, although each submission was considered. Time constraints prevented the Committee from holding its own public meetings.

  Its report of 63 pages made 127 generic recommendations on matters which it referred to the Department of Water Resources for further consideration. Each of these matters was examined in drafting the final Bill, which was considered by Parliament in the Spring Session of 1989.

An elaborate public consultation procedure was held in *Victoria* (Australia) (Box 10), consisting of a Discussion Paper, Issues Papers, other detailed papers, group workshops, explanatory missions, public meetings, etc. An Independent Committee of Review was appointed, which distributed a large number of copies of the draft Bill and received evidence from many interested parties.

In all the above cases, the careful preparation of the ground for reforms by issuing public documents and eliciting comments by interested parties paid off in easing the eventual passage of legislation or policy measures.

Turkey's experience with management reforms is of interest for its potential relevance to Asian countries with large public irrigation infrastructures. The review process (Box 11) has been progressing for more than 10 years and has explicitly recognized the need to establish institutional linkages and inter-agency cooperation to effectively manage a complex national water resources sector, rather than establish or continue with one highly centralized agency. One initiative to improve inter-agency coordination has been the computerization

BOX 11: NATIONAL WATER SECTOR POLICY REVIEW IN TURKEY

The water sector review included the following steps:

Justification for the review

- Provision of sustainable and environmentally sound water resources development.
- Growing regional imbalance between water demand and availability (supply-demand imbalance).
- Changed water uses no longer matched both urban and rural distributional availability.
- Unreasonably high investment in the water sector.

Initiatives

- Preparation of an irrigation master plan and strategy review.

Draft policy document and public consultation

- Several laws and regulations drafted on private sector participation and environmental protection.
- Proposal to parliament for a legislative change to accelerate transfer of responsibility for O&M of irrigation systems to the users.
- Workshops for transfer programme.
- Annual review based on master plan.

Main thrust of policy review and reform

- Institution and capacity building for environmental protection.
- Raise water use efficiency and improve quality of water services through enhanced role of water user organizations, privatization and re-orientation of cost recovery.
- Support to regional development projects, such as the Southeast Anatolia Project (GAP) and the Central Anatolia Project (KOP).

Legislation

- Environmental Protection Law enacted by parliament in 1983.
- Law allowing private sector to build and operate (BOT) hydropower plants enacted in 1984, and amended and expanded in 1994 to cover water supply sector.
- Amended legislation concerning late payment penalty to be imposed on water fees and facilitating transfer of O&M equipment and machinery to private users along with the system.

and development of open-access information systems for surface water and groundwater data, based on comprehensive national investigation programmes: it is proposed that a national, autonomous, natural resources data centre be created, to include all water-related information. Environmental considerations and sustainable water development have been incorporated into water resources management objectives since the mid-1980s, and private-sector development has been encouraged in hydropower, metropolitan water supply and irrigation.

Considerable problems still remain with the allocation of rights and competing uses in the most developed river basins, where a range of national, regional and customary law has held sway and is now unequal to the task of resolving conflicts over development and allocation. Competition between irrigation and urban water uses has brought the need for integrated national water management into sharper focus in recent years. Participation in agricultural water management has been a feature of irrigation development since the 1950s, but the comparatively poor rates of cost recovery compared to private-sector irrigation have encouraged a rapid acceleration in the transfer of complete irrigation systems to water users, including three systems larger than 10 000 ha. Turkey continues to have a large and active water resources development programme for irrigation, flood control and inter-basin transfer for urban water security.

Review outcomes

The main outcomes of the reviews conducted in the countries listed in Table 3 can be considered under four main headings: reforms in water rights; privatization and corporatization; the promotion of prices and market mechanisms; and planning and management reforms.

Reforms in water rights

In *France* and *Victoria* (Australia) reforms amounted to replacing systems of water abstraction and use based on rules of custom – most notably, riparianism – administered by the courts through litigation among water users, with systems based on Government-administered permits. *Chile*, in contrast, is considering tightening up a loose system of Government-administered permits.

Broadly, in the first two countries, riparian proprietors were free to abstract and use water from a stream or from under their land. The option of switching to a radically different system requiring a Government permit for water abstraction and use had implications for the legitimate water rights held by riparians, who stood to suffer a loss of property rights through no fault of their own.

The legal implications of the changes were (a) the need to radically change the existing law governing water abstraction and use, particularly by riparian proprietors, and (b) whether riparians should be compensated for the loss they would suffer in their legitimate property rights. The same issues arose in *Chile*, where reforms were considered to an exceedingly generous water rights system which conferred unrestrained powers akin to ownership over the waters covered by the grant. Owners of such rights might feel entitled to some form of compensation for the loss they stand to suffer.

This issue was dealt with differently in the various countries. In *Victoria* (Australia), riparian landowners were substantially 'compensated' through the new legislation acknowledging their continued right to abstract and use water without a Government permit for certain limited uses only. In *France*, the rights of riparian landowners to abstract and use water were unaffected by the new law, but, at the same time, they became subject to registration with the Government for further administrative disposition under either a simple

declaration regime or a more restrictive permit regime. *Chile* seems to have taken the approach of leaving unaffected all rights which have accrued under the existing legislation.

Privatization and corporatization

This was a major theme of reforms carried out in *England and Wales* (United Kingdom), *Victoria* (Australia) and *Mexico*. In all three countries, water supply, sewerage and sewage disposal services used to be a public sector responsibility, and in Mexico likewise for the provision of irrigation water supply services. For both efficiency and public revenue motives, all three countries chose to privatize or corporatize their water services.

Different solutions were adopted for the problem of regulating prices in a monopoly or near-monopoly situation. In *England and Wales* (United Kingdom) (Box 12) tight statutory requirements have been placed on the newly formed private companies, particularly in regard to the quality of service and charges. The power of the service companies to fix

BOX 12: WATER POLICY REVIEW IN ENGLAND AND WALES (UNITED KINGDOM)

In the United Kingdom, the policy of privatization of the water industry in England and Wales took shape as follows:

- February 1985: debate in the House of Commons on the Water Authorities (Return of Assets) Order. The Government tried to get Thames Water Authority to make accelerated repayment of a loan, which would have caused a 10% increase in water charges. The Authority informed the Government that it would repay the loan only after having received the approval by a Motion of the House of Commons, which in the event the Government won by a narrow majority. This spurred the Government's interest in privatizing the water industry.
- February 1986: publication of a Government White Paper on *Privatization of the Water Industry in England and Wales*. In this paper, the Government announced its proposal to transfer the ten Regional Water Authorities into the private sector without any change of functions, thereby preserving the concept of integrated water resources management.
- March-April 1986: the Government releases two consultation papers on, respectively, water and sewerage law, and the water environment. The decision to form a separate body for water pollution control and water resources management was first announced in April 1987.
- The House of Commons Select Committee on the Environment presents a report on the existing water pollution control arrangements. The environmental lobby and the Confederation of British Industry advocate transferring the regulatory functions of the Water Authorities to a public independent body.
- June 1987: general elections, won by the Conservative Party.
- July 1987: the Government publishes a proposal for a public regulatory body in a privatized water industry, namely the National Rivers Authority.
- October 1987: Second Reading, in the House of Commons, of the Public Utilities Transfers and Water Charges Bill. This Bill (then passed in 1988) authorized the Water Authorities to reorganize themselves internally into utility and regulatory divisions.
- December 1987: publication of *The Government Policy for a public regulatory body in a privatized water industry*. The paper reflected the criticisms of some of the proposals in the 1986 White Paper, and laid out the structure of divided regulatory and water service responsibilities, which was incorporated in the Water Bill.
- 24 November 1988: the Water Bill is released.
- 6 July 1989: the Bill is enacted into law as the Water Act 1989.
- 25 July 1991: review and consolidation of water resources management under the Water Resources Act 1991, repealing the water resources management elements of the 1989 Act.

charges has been made conditional on the prior governmental approval of company proposals – the so-called Charges Scheme. The powers and obligations of service companies are further spelt out in the terms of their Operating Licence.

The task of supervising the standards and levels of service, the maintenance of the water infrastructure and the levels and amounts of the charges of the water service companies is entrusted to the Director General of the Office of Water Services – a non-ministerial government department. The Secretary of State or the Director General of Water Services have been given powers by the Water Act 1989 to make provisional or final enforcement orders against water service companies.

In *Victoria* (Australia), the Melbourne and Metropolitan Board of Works and the Rural Water Commission were corporatized through separate Acts of Parliament passed in July 1992. The Commission has been turned into a Corporation and its Board of Management restructured to include commercial, legal, financial and water management expertise. Public control of its operations is achieved through rolling three-year performance contracts, to be negotiated between the Corporation and the Minister responsible for water. Regional Management Boards have also been established, with delegated powers and similar operating modes.

The Rural Water Corporation will act as a 'holding corporation' and be responsible for maintaining State-wide hydrological services. Two subsidiary service corporations will

BOX 13: A NEW WATER LAW IN FRANCE

Water rights in France have recently undergone a thorough renovation. The law of 3 January 1992 considers water as a common heritage and thus closely associates the users of the country's six hydrological basins in its management. It is based on an integrated approach with a dual objective: user satisfaction and conservation of the natural environment.

The Ministry of the Environment masterminds water policy, lays down regulations and organizes overall planning in consultation with, and assisted by, the Inter-Ministerial Water Council. Specific aspects of water management are entrusted to technical ministries. The *prefets*, aided by territorial public services, are responsible for local policing of water and fishing. They authorize uses and discharges, apply legislation specific to pollution or dangerous installation, ensure conformity to quality objectives and approve planning documents (water and fishing).

An original organization

The Law encourages consultation among all water-use partners, whose needs are often contradictory, by means of a planning system that designates legitimate water use: the Water Development Scheme *(Schéma d'aménagement et de gestion des eaux (SAGE))*.

This planning tool is prepared at the local level by the local Basin Committee, and covers a catchment area or river. The local authorities may provide financial aid for planned developments.

Overall coordination at the level of a major hydrographic basin is ensured by the Main Water Development and Management Scheme *(Schéma directeur d'aménagement et de gestion des eaux (SDAGE))*, as drawn up by the Basin Committee and approved by the national authorities.

The Basin Committee is a *de facto* 'Regional Water Parliament'. It organizes meetings among representatives of users, associations and local authorities, who form the majority, as well as State representatives. It fosters consultation and solidarity. It defines the policy and management of the catchment area. It pronounces on the fixing of charges and on the intervention programme tabled by its executive, the Water Agency.

At national level, the National Water Board brings together representatives of different user categories, catchment area structures and public services, and gives its opinion on national water management policy.

be set up to provide technical, financial and administrative support to Regional Management Boards, which are due to be fully privatized in mid-1995.

In *Mexico,* the new Federal Water Act confers on irrigation water users' groupings the legal status and powers needed for them to effectively manage the irrigation systems, which are scheduled for transfer from the Government to the private sector. The service customers sit on the Board of management of the public irrigation companies. At the state level, legislation has been enacted to strengthen the financial and managerial flexibility of the urban water and sewerage utilities by turning them into commercial companies with authority to fix and collect service charges and to cut off service for non-payment of charges due. The managing boards of these companies contain, amongst others, customers' representatives, in an attempt to ensure some accountability.

Promotion of prices and market mechanisms

One attendant legal issue is the legal status of water vis-à-vis the land it 'serves,' i.e., whether water rights should be tied to ownership or possession of the land and to a particular use, or should have independent status. Another is reconciling the uniquely distinctive public good connotation of the 'commodity' water with the profit motivation of market-driven water rights holders' allocation decisions.

In *Victoria* (Australia), restricted water markets were allowed to develop in the irrigation sector alone, and within the same irrigation district or among different irrigation districts. Transfers are subject to prior screening and approval by the irrigation district authorities, who may impose restrictions on such matters as: the minimum amount of water rights that must be retained by any landowner in an irrigation district; the maximum amount of water rights which may be held by any such landowner; and the out-of-district transferability of water rights. Transfers can be seasonal or permanent, with water 'attaching' to the land of the transferee in the latter case. Attachment of water rights to the land implies that the former cannot be transferred separately from the latter, and restrains speculation.

In *Mexico,* the new Federal Water Act allows the transfer of water rights, subject to prior Government approval if the proposed transfer affects the rights of third parties or the hydrology or ecology of the basin (or aquifer, in the case of groundwater). Water markets are also allowed to develop within a basin or aquifer on the basis of regional, basin-wide, state-wide or local stipulations made by the Government. Under the new Act, however, groundwater cannot be transferred separately from the land.

In *Chile,* water rights which have accrued under the existing legislation and those which will be granted under the new legislation will remain freely transferable to different uses and places of use through market transactions. However, all transactions involving water abstraction works will require prior Government authorization. Furthermore, in the arid north of the country transferability will be effectively impeded in so far as water rights are made to terminate automatically when the use for which they have been granted ends.

Planning and management reforms

Responsibilities in the water sector in *France* were consolidated in comprehensive legislation passed in 1992. The Basin system, dating back to the 1960s, balances central responsibility with regional and local decision-making and control. The country is divided into six river basins, and coordination in each is provided by the Basin Committee, which, in effect, acts as a regional water 'parliament,' in which users confer and resolve their different needs (Box 13). The main features of the 1992 legislation were to empower local communities, and to enhance the powers of the *Agences financieres de bassins* - now *Agences de l'eau.*

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Appendix 1
Indonesia's draft National Resources Policy Action Plan 1994 – 2020

DRAFT NATIONAL RESOURCES POLICY ACTION PLAN (INDONESIA, 1994 - 2020)

POLICY	WATER RESOURCES MANAGEMENT	SOCIO ECONOMICS & FINANCE	ENVIRONMENTAL MANAGEMENT	LEGISLATION & ADMINISTRATION
		I. WATER UTILIZATION		
1. TO PROVIDE ALLDCATION AND UTILIZATION CONDUCIVE TO ECONOMIC AND SOCIAL DEVELOPMENT AND ENVIRONMENTAL SUSTAINABILITY	Objective: To make efficient and equitable allocation and utilization of surface and groundwater among sectors considering long-term impacts 1. To base water allocation on water balance in River Basin Plans. 2. To administer, implement and enforce an integrated national licensing mechanism of surface and groundwater abstraction and use based on River Basin Plans. 3. To review and assess options for and develop allocation mechanisms for inter-River Basin transfers and water exports	Objective: To link the water sector with and respond to demographic shifts and changes in the social and economic sectors 1. To use cross-sectoral analysis, planning and development to evaluate and implement present water utilizations and in particular: - compile River Basin baseline descriptions on linkages between water utilization and interactions between the water sub-sectors and (a) macro- (fiscal, monetary and trade) and economic policy instruments and (b) intersectoral, intrasectoral, distributional and environmental impacts - identify and address related trade-offs and ways of accommodating them in and between the River Basins 2. To identify and formulate the role of water security within the context of national economic security 3. To assess and optimize influence of water policy (a) between economic sectors (b) between national and regional levels and (c) among households and firms 4. To identify options for water policy as rational strategy for economic and regional development 5. To adopt water resources management policy to fiscal austerity, reduced producer subsidy and reduced public share of public water resources investment and other structural adjustment measures and capital instruments for effective utilization	Objective: To adapt water allocation to eco-system management approach: 1. To establish water resources accounting systems for sustainable utilization at national and River Basin levels. 2. To identify and study the linkages between water utilization, public health and environmental protection. 3. To design and implement programmes for the enhancement of public awareness of water availability and utilization economy, and related rights and responsibilities	1. Issue and enforce Guidelines for implementation of water licensing regulations. 2. To issue a joint decree of the Ministers respectively responsible for water resources and for mining and energy delegating to the Minister responsible for water resources the allocation of surface and groundwater through a unified licensing mechanism.

POLICY	WATER RESOURCES MANAGEMENT	SOCIO-ECONOMICS & FINANCE	ENVIRONMENTAL MANAGEMENT	LEGISLATION & ADMINISTRATION
2. TO IMPROVE THE EFFECTIVENESS AND EFFICIENCY IN THE UTILIZATION OF WATER	Objective: To reconcile efficiency and equity 1. To institute a system of water service contributions from the users to improve water use efficiency 2. To encourage conjunctive use of surface and groundwater through licensing system and water service pricing 3. To classify water resources for optimal utilization based on availability, quality, amenity and other values 4. To establish a system of bulk allocations of surface water by efficiency considerations through consolidated licenses	1. Improve technical efficiency by introduction of appropriate technology for reduction, re-use and recycling 2. Improve economic efficiency by developing (a) reduced water production costs (b) higher production per unit of water (c) cross-subsidies within the River Basin (d) cross-subsidies between River Basins 3. Establish and enforce use based water service charges to achieve allocation and cost-recovery objectives for water management in the River Basin. Water service charges will be based on actual long term marginal water costs	1. Identify and address environmental trade-offs of efficient water utilization 2. To respond to requirements for effective integrated natural, human and man-made resources management in the River Basin Plan 3. To design and implement programmes for the evaluation and management of long-term cumulative impacts of water resources development 4. To establish independent screening procedures for EIA 5. To ensure proper timing of EIA in the project cycle 6. To ensure inform and alert and consumers of product-related effects on water through environmental labelling	1. To incorporate in existing water licensing regulations provisions to the effect that water saved through efficient use of licence holder's entitlement is for Government to dispose of under River Basin Plans 2. To include in the Guidelines for the implementation of water abstraction licensing regulations: a. provisions for water and water resources use-based service charges b. provisions for the routine inclusion in water abstraction licences of clauses for technical and economic efficiency of water use. 3. Limited to Provinces which have not yet done so, draft Provincial Government Regulations for the implementation of the wastewater charging provisions of Government Regulation 20/1990 on water pollution control 4. To review legislation on EIA and incorporate independent screening procedures and ensure proper timing of EIA in the project cycle

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		II. WATER QUALITY		
3. TO PROVIDE LEVELS OF QUALITY IN INDONESIA'S WATER RESOURCES WHICH ARE CONDUCIVE TO ECONOMIC AND SOCIAL DEVELOPMENT AND ENVIRONMENTAL SUSTAINABILITY	1. To administer and enforce a combined national licensing system for water abstraction and waste water discharge based on River Basin Plans. 2. To establish priorities for water quality control based on population density. 3. To strengthen national and regional capacity for R&D in water quality management by: - improving water quality information - developing appropriate technology for waste water treatment - identifying needs, activities and resource requirements for water pollution control - coordinating with urban and rural sanitation strategies 4. To identify and declare water resources protection areas 5. To control sedimentation through adequate watershed management	1. To establish mechanisms for cross-sectoral policy analysis, planning and development 3. To review policies on agricultural inputs and their effect on water quality 4. To establish and enforce water service effluent charges for efficient water management and recovery of water pollution control service costs within the River Basin 5. Establish and enforce a water resources conservation charge on land uses in the catchment with an impact on water quality 6. To review and assess the effectiveness and efficiency of the current and proposed water quality standards for water resources management	1. To inventory and assess flora and fauna threatened by water pollution and ensure their protection 2. To design and implement programmes for water quality management in coordination with existing and on-going activities 3. To review economic and policy measures to increase compliance with pollution control measures	1. To institute and enforce a combined licensing system for water abstraction and wastewater disposal based on River Basin Plans by mutually reconciling Min PW Decree 45/1990 on water pollution, Min PW Decree 49/1990 on water abstraction licensing, Government Regulation 22/1982 on Water Resources Management and Government Regulation 20/1990 on Water Pollution Control. 2. To include in the standard forest logging concession agreement payment of a water resources conservation charge on land uses in the catchments with an impact on water resources. 3. To draft legislation restricting social and economic activities in and around water bodies, catchment and recharge areas, consistent with Spatial Land-use Plans, to protect water sources

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III. WATER RESOURCES DEVELOPMENT				
4. TO DEVELOP WATER RESOURCES UNDER THE NATIONAL WATER RESOURCES DEVELOPMENT PLAN (NWRDP) BASED ON RIVER BASIN PLANNING.	Objective: To move to a planned programme approach for water resources development 1. To develop and establish a participatory, interactive and consensus seeking process for River Basin Planning for national and provincial River Basins. 2. To integrate river basin planning processes and instruments with spatial planning processes and instruments. 3. To identify priorities for the formulation of River Basin Planning based on (a) water balance (b) water pollution (c) River Basins as Special Development Areas 4. To complement existing flood control programmes with zoning of floodplains and disaster preparedness in coordination with Spatial Land-use Plans 5. To create capacity for River Basin Planning; secure collection and processing of data for River Basin Planning	1. To establish a River Basin Planning process interactive with mainstream planning for preparation of NWRDP 2. To prepare regional development strategies based on River Basin Planning in regions with water scarcity and in particular regions with: (a) critical water availability and/or subject to flooding (b) upstream - downstream interdependence for water availability and/or flood divided by administrative boundaries 3. To give recognition to and reflect changes in macroeconomic policies in development of River Basin Planning 4. To address and accommodate trade-offs between development objectives in the development of River Basin Planning 5. To establish the interactions between water producers and users in the River Basin Plan 6. To introduce efficient flood plain management under River Basin Plans	1. To establish and implement a participatory and interactive process for EIA of River Basin Plans and of Spatial Plans 2. To protect aquatic habitats including lakes, wetlands and coastal waters through regulation, incentives and in River Basin Plans 3. To design and implement conservation programmes with increased public participation 4. To manage soil conservation and water-shed management in the formation of River Basin Plans 5. To reflect and give recognition to traditional and cultural values in the formation of River Basin Plans.	1. To draft and implement legislation regulating River Basin Planning consistent with Spatial Land-use Planning 2. To incorporate in existing EIA regulations and implementing mechanisms a requirement for EIA of River Basin Plans and Spatial Plans 3. To enact and implement legislation water resources related disaster preparedness 4. To investigate water related customary law and practices and assess their relevance and impact on River Basin Planning

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5. TO ENHANCE PRIVATE SECTOR AND COMMUNITY PARTICIPATION IN FINANCING OF WATER RESOURCES DEVELOPMENT	1. To establish, under the control of the Government : (a) New River Basin branches of PERUM Jasa Tirta, and Provincial State Companies (PERUMOA), as organizations for water resources development (b) Formal Water Users' Groups 2. To identify and prepare viable programmes for private participation in water resources development through joint ventures with the Government 3. To establish schemes to encourage controlled self-development of surface and groundwater	1. To identify viable financial schemes and instruments to attract financial resources from private interests and the public,in accordance with deregulation policy and, in particular, - review, under River Basin Planning, the potential for acquisition of private financial resources for water resources management and development 2. To review water service charges for compatibility with private sector participation	1. Delegate financial responsibilities and benefits to the immediate beneficiaries	1. To draft legislation to give User's groups legal status before the law and to enable them to function in a corporate capacity 2. To draft legislation to enforce the beneficiaries' responsibility for O&M of main water works 3. To draft legislation enabling and motivating the public, including financing institutions to participate in financing water resources management and development and establishing relevant procedures and requirements
6. TO ESTABLISH A SUSTAINABLE BUDGET SYSTEM FOR WATER RESOURCES MANAGEMENT.	1. To establish independent annual and multi-annual capital budget components, based on River Basin Plans for Water Resources: (a) Water management administration (b) Water Resources Planning (c) River Improvement	1. To make balanced appropriation of budgetary resources between management including improved services to the public, development and O&M 2. To institute a system of water abstraction and wastewater discharge contributions. 3. To secure specific Government budgetary appropriations for water resources enhancement for all purposes.	1. To secure budgetary resources for water conservation and environmental protection measures 2. To provide budget for environmental management and monitoring plans at the River Basin level, out of project funds	1. To adjust legislation on national budget structure so as to accommodate a sustainable budget for water resources management

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IV. WATER RESOURCES MANAGEMENT STRUCTURE				
7. CREATE A WATER RESOURCES MANAGEMENT STRUCTURE CONSISTENT WITH INTEGRATED MANAGEMENT OBJECTIVES	1. To coordinate water resources management activities. 2. To establish a structure and capacity for water policy development and for monitoring of water resources planning, management and development. 3. To establish central government water resources management capacity including River Basin Planning and allocation for water abstractions, waste water discharges and other water uses of surface and groundwater resources (National River Basins) making use of existing structure and manpower. 4. To entrust operational water management functions at basin level in National River Basins to branches of Perum Jasa Tirta in (a) River Basins or groups of basins that are financially viable; (b) non-viable basins or groups of basins to be supported by inter-basin cross-subsidies. 5. As an intermediate arrangement in river basins that are not financially viable, to entrust operational water management with non-structural Technical Units (UPTs) 6. At the Provincial level, to structure Technical Units (UPTs) along River basin lines for River Basin Planning and the integrated quantity and quality management of surface and groundwater resources of Provincial River Basins	1. Subsidize the implementation of River Basin Plans as required 2. To identify and confirm the financial viability of river basin management areas based on economy to support and populations served by water resources management	1. To develop institutional to integrate water resources management within the frame of natural resources management	1. To consider : (a) structuring the National Water Resources Council as a Committee of Ministers at policy making level, and a Technical Committee of Directors-General; (b) coordinating the Council with the National Spatial Planning Committee through the Council chairman becoming an <u>ex officio</u> member of the said National Committee.

FAO LAND AND WATER BULLETINS

1. Land and water integration and river basin management, 1995 (E)
2. Planning for sustainable use of land resources – Towards a new approach, 1995 (E)
3. Water sector policy review and strategy formulation – A general framework, 1995 (E)

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In many countries, as a consequence of inadequate water policies and strategies and institutions to implement them, the quantity or quality of fresh water resources is imposing limits on current water use and on economic development. This publication provides a holistic approach to water sector policy review and strategy formulation, delineating and elaborating on the elements to be included in the process. Based on recent specific guidelines by FAO, the United Nations Development Programme (UNDP) and the World Bank, the framework emphasizes the importance of capacity building and consolidates the stages of review and adoption of water policy with the formulation of strategies for implementing the policies. Components of the policy review include water resources assessment, identification of problems and issues and evaluation of available policy options. In formulating strategies for the definition of an action programme and an implementation schedule, participation of the interested parties (stakeholders) is important. Key issues such as economic tools, information systems, environmental and health considerations and international issues are considered in detail. A section presents recent experiences and outcomes of water resources reform in developing and industrialized countries.

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